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CENTRAL INTELLIGENCE AGENCY

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SECRET

COUNTRY East Germany

SUBJECT Technical Description of the Anti-Collision Marine Radar Device KSA-3 (FGS-392)

REPORT

DATE DISTR. 19 FEB 1963

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50X1-HUM

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THIS IS UNEVALUATED INFORMATION. SOURCE GRADINGS ARE DEFINITIVE. APPRAISAL OF CONTENT IS TENTATIVE.

Anti-Collision Marine Radar Device KSA-3, known commercially as the FGS-392, manufactured by VEB Funkwerk Koepenick. On the following pages, tables of contents of the English translation of three of the documents are given.

50X1-HUM

Attachments:

Description of the FGS-392 and Installation Instructions (Part I and Part II) These basic documents were prepared in 1959.

Commerical brochure on the FGS-392 issued by VEB Funkwerk Koepenick.

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GROUP 1
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Part I

DESCRIPTION OF DEVICE (Attachment A)

Part II

INSTALLATION INSTRUCTIONS (Attachment B)

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OPERATING INSTRUCTIONS

MAINTENANCE INSTRUCTIONS

APPENDIX

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FINAL REPORT (Attachment C)

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UNEDITED ROUGH DRAFT TRANSLATION

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DESCRIPTION OF THE FGS 392 SHIP'S RADAR INSTALLATION

BY: Muller

English Pages: 119

SOURCE: Beschreibung der Schiffsrader-Anlage FGS 392, Part II, 28 August 1959, pp. 1-112.

50X1-HUM

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Declassified in Part - Sanitized Copy Approved for Release 2013/01/25 : CIA-RDP80T00246A066200010001-5

INSTALLATION INSTRUCTIONS

~~The installation instructions consist of pages 1 through 39.~~

~~TABLE OF CONTENTS~~

50X1-HUM

Declassified in Part - Sanitized Copy Approved for Release 2013/01/25 : CIA-RDP80T00246A066200010001-5

Declassified in Part - Sanitized Copy Approved for Release 2013/01/25 : CIA-RDP80T00246A066200010001-5

KSA 3

Installation Instructions

1. Choice of Location for Installing Apparatus

There are special points to be noted in selecting the locations for setting up the various parts of the installation, in accordance with its intended application (land or ship operation).

1.1. It frequently occurs that ships, and motor ships in particular, have one or several zones subject to severe vibration, either continuously or at least at critical engine rpm's. If parts of the installation are mounted in such vibration zones, we must reckon not only with detrimental effects and shifting mechanisms, wire breaks, and other mechanical damage, but also with errors in the readings or throwing off of the frequency.

Before the point of installation is decided upon, the yards or the ship's officers must identify these "vibration zones" if such are ~~at hand~~ present.

All components of the installation that give rise to noise (rotary antennas or converters) must be arranged in such a way that they do not annoy the crew or the passengers.

Care must also be taken in installing the units so that enough room is left after securing it to permit opening them so that any necessary measurements or repairs can be carried out without blocking off passages or important work areas that must remain accessible.

1.2. A 3 Directional Antenna

The antenna is of sprayproof design and suitable for mounting in an exposed position. Selection of the point for installing the

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antenna is probably the most difficult problem encountered in the entire job of installing the radar on a vessel.

Although it would be desirable, it is seldom possible to obtain an unobstructed line of sight in all directions. The most commonly encountered obstacles to the radar survey are stacks, masts, and pole masts. When the antenna reflection can look out over all these obstacles, we have attained the ideal situation. The disturbances originated by the thin masts are relatively minor. Shrouds, braces, and guy wires represent perceptible obstacles when present in great profusion and may result in poor reception in a given sector. Stack shading can be avoided by elevating the antenna. This, however, usually places us at the level of the fore crosstrees, which gives rise to a dangerously broad shadowed sector ahead of the ship. Normally, the crosstree is 2.5 to 3 meters above the compass platform, i.e., exactly at the level of the rotary antenna. It is most advantageous to have the antenna about 1 meter below the crosstree.

The radar antenna should not be located too high above the ship without highly cogent reasons. The range gained by increasing the height (the distance to the radar horizon increases as the square root of height) is not the only decisive factor. If mounted too high, the antenna can easily push up into atmospheric layers of quite different character, so that while it may pick up distant targets, it may not be able to penetrate into the lower layers, which are particularly important for piloting, so that nearby targets are not satisfactorily indicated.

Standard heights for radar antennas on ships cannot be indicated. However, experience has ~~indicated~~ shown that heights of 8 to 15 meters for small vessels and 25 meters above the water line in the case of large vessels fully satisfy all navigational requirements.

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The antenna may be mounted on the compass deck, on a platform at the foreward or after mast, or on a special radar mast. A vibration-free mounting and convenient maintenance should be kept in mind. If traffic safety is emphasized, the antenna height selected should be smaller.

If possible, the stack plating should be avoided as the antenna carrier. It is generally of highly labile construction, so that the antenna cannot be given a vibration-free mount. Further, the antenna is easily fouled by the exhaust gases, particularly when the vessel is at a standstill; hot exhaust gases also interfere with the radiation of energy.

Now should the antenna be placed in the centerline of the ship, or should it be offset to one side?

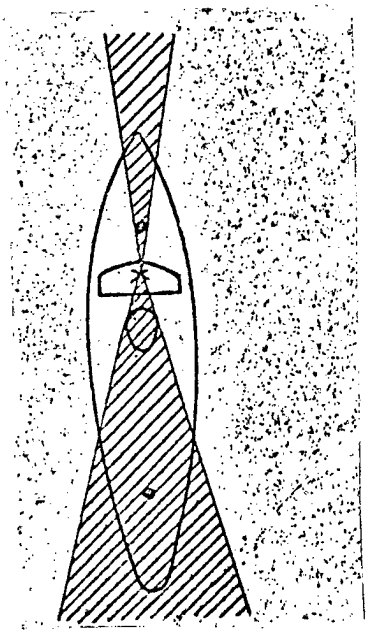

Fig. 1.

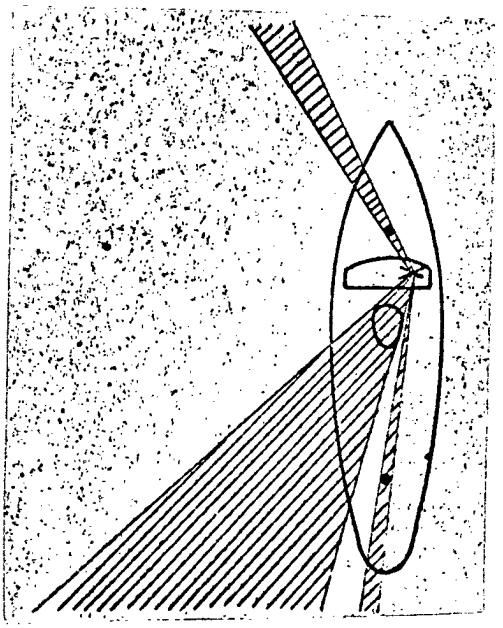

Fig. 2.

It should give pause to note that while an installation in the centerline of the ship will indeed give all radar bearings without distortion with respect to the longitudinal axis of the ship, which is particularly favorable in narrow channels, the radar shadow of the foreward mast falls dead ahead along the extension of the ship's

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longitudinal axis (Fig. 1).

If we decide in favor of a lateral offset for the antenna, we should select that side of the vessel on which the main display unit is mounted. This will eliminate the parallaxes that would otherwise occur, or at least hold them to a minimum. For operational reasons, this will usually be the starboard side. The positions and sizes of the shadow sectors must be determined before the point of installation is fixed. A table indicating these sectors should be posted in the vicinity of the display unit (Fig. 2).

It should be noted further that obstacles which give rise to shadow sectors must be at the greatest possible distance from the antenna so that the sectors will be kept small. The reflected transmission energy may be so strong that it burns out the silicon diodes at the receiver input. Inevitable interfering, nearby reflections can be weakened or "extinguished" by the use of deflection mirrors or a damping material. If the last-named measures are necessary, it is recommended that the manufacturer of the radar installation be consulted.

Lastly, there are still a few factors to take into account in selecting the point of installation for the antenna that do not have any relationship with the mode of operation of the installation.

The stays (guy wires) of the radar mast should not be allowed to interfere with the ~~radar operator's work~~ directional radio antenna. They must be broken up into several short, isolated segments.

The primary factor to be considered with small vessels on which the antenna is low-mounted is that no danger to personnel arises as a result of rotation of the radar antenna.

In stationary operation on land, it makes no difference whether trees, hills, towers, masts, and other structures or obstacles are

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interfering with propagation of the centimeter-wave energy in the region to the rear. In order to obtain satisfactory bearings over a sea range, however, the antenna must project above all obstacles located between the antenna station and the open sea.

The longest possible range is generally the objective in this case. For this reason, the antenna must be mounted as high as possible, still taking into consideration the specifications for the final form of the waveguide.

→ 1.3. G 3 Transmitter-Receiver Unit

If the architectural situation on the vessel permits, G 3 should be mounted vertically below the antenna and as close to it as possible (with at least 50 cm between flange and cover).

The shape and length of the waveguide train (energy conductor) connecting G3 with A 3 and, consequently, the performance of the entire installation, are directly related with the selection of the points at which A 3 and G 3 are installed. It is absolutely necessary to remember that the conductor losses increase with increasing conductor length. For the same reason, the elbows or angle pieces necessary for changing the direction of the waveguide train are to avoided or their number held as small as possible. In any waveguide installation, therefore, we must reach a compromise between waveguide length and the number of ~~corners~~ angles on the one hand and the extent of the power losses that we can accept on the other.

Waveguide lengths over 10 meters are not to be permitted.

G 3 is designed only for vertical suspension on a wall. It is ~~protected from dripping water~~ drip-water designed ~~rainproofed~~ and may therefore be installed only in closed compartments. The air humidity in these compartments may not exceed the maximum normal atmospheric humidity attained in the atmosphere as a result of weather disturbances.

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Instruments or installations that can be disturbed or affected by magnetic fields (magnetic compasses, measurING instruments and other nautical equipment must be at least 4 meters distant from the transmitter-receiver unit. For this reason, it is not permitted to remove the covering hood of the G 3. If the hood is removed for repairs or measurements, the influence exerted by the magnetic field emanated from the magnetron magnet upon the other instruments or devices will increase. This also applies when the radar is shut off.

Where space considerations permit, particularly on ships, G 3 should be set up in a separately shielded radar room.

1.4. N 3 Low-Voltage Line Unit

Like G 3, N 3 is also designed as a wall instrument and must be installed in a vertically suspended position. The type of design which is drip-water protected dictates installation in closed compartments, as in the case of G 3.

It is recommended that N 3 be secured in the immediate vicinity of G 3, if possible directly beside G 3, in order to facilitate maintenance and control measurements.

1.5. H 3 Main Display Unit

In land operation, H3 belongs in the operations room, so that the screen images can be evaluated directly. Apart from this, the control knobs by which the entire KS [Anticollision] installation is placed in operation, controlled, and shut off are mounted on the front of H 3.

On board ships, the main display unit should be mounted in such a way that the watch officer has the broadest possible view of the sea space under observation simultaneously with the ability to inspect the screen image. It must be taken into consideration that the watch officer has to observe this sea space not only optically, but

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acoustically as well.

If there are no restrictions on the selection of the side of the bridge, preference is generally given to the starboard side.

H 3 is designed to rotate in its tube chassis. This makes it possible to install the display unit on a pillar or on a table, but it can also be placed on a vertical wall or hung from the ceiling.

Regardless of whether a magnetic or gyrocompass is used on board, it is recommended in view of the necessary compass checks that only the minimum distance (1.5 meters) dictated by interference considerations be left between the compass and the display unit so that quick and accurate checks can be made on the course currently being followed.

Care must be taken to ensure that the instrument is not exposed to direct heat radiation from radiators.

The maximum permissible distance between G 3 or N 3 and the display units is 50 meters. If a longer separation is absolutely necessary, the manufacturer should be consulted prior to installation. Special measures are necessary in this case.

The display unit is designed to be ~~rainproof~~ drip-water proof and should be installed only in closed compartments.

1.6. T 3 ~~Daughter~~ Slave Display Unit

T 3 must be set up in a closed compartment. The location can be selected at will and is left to the customers.

In many cases, the map room is equipped with a ~~daughter~~ slave display unit so that the navigation ~~staff~~ personnel can make comparisons between the sea ~~map~~ chart and the radar-screen image. For the rest, what we have already said in regard to H 3 also applies for T 3.

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1.7. Current Supply

1.7.1. Direct Current

The current-supply unit incorporates:

a) converter
b) field regulator
c) marine self-starter
d) distributor box

1.7.2. Polyphase

In this case, the current-supply system includes:

a) converter
b) field regulator
c) auxiliary line unit

The converter's noise dictates installation of the complete power-supply unit in any available converter space, in the engine room, or in some other suitable compartment in which generation of noise is permissible or justifiable.

2. Securing Installation Components at Place of Installation

2.1. A 3 Directional Antenna

To mount the antenna at the position selected, it is necessary to build an installation platform to which the antenna is flange-mounted.

2.1.1. On-Land Construction

For land installation, it must first be determined whether the screen image is to be "north"-oriented or "sea"-oriented.

2.1.1.1. "North"-oriented screen image

In this case, the north direction is to be marked ~~out~~ on the installation platform. The drive housing of the antenna carries a plate with the inscription "dead ahead" and a corresponding graduation mark, the so-called "dead-ahead mark" (Fig. 3).

This dead-ahead mark is made to coincide with the marked north direction after the antenna has been set up; this is followed by

Declassified in Part - Sanitized Copy Approved for Release 2013/01/25 : CIA-RDP80T00246A066200010001-5

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marking and drilling of the (14-mm) mounting holes.

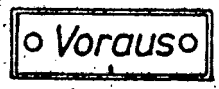

Fig. 3.

2.1.1.2. "Sea"-oriented screen image

Here it is necessary to mark on the installation platform the direction which we wish to assign to the coastline crossing. Then the antenna is set up and the identical procedure followed as in the "north"-oriented installation. The antenna is secured to the installation platform with 12-mm bolts whose length depends on the thickness of the installation platform.

2.1.2. On-Board Structures

Here the basic installation procedure results in "dead-ahead" orientation of the antenna. The dead-ahead direction (longitudinal axis of vessel) is marked on the installation platform and the antenna is set up. The dead-ahead mark is aligned with the mark made for the dead-ahead direction, and the rest of the procedure is the same as described under 2.1.1.

2.2. G 3 Transmitter-Receiver Unit

The installation of G 3 presents no particular difficulty. The instrument is bolted to the vibration-damping connectors at the previously selected location.

2.3. N 3 Low-Voltage Line Unit

The remarks made under 2.2 apply for N 3.

2.4. H 3 Main Display Unit

H 3 is to be secured with 8-mm bolts. The bolts are turned through the collars on the tube chassis. It is necessary to make sure that the instrument can still be pivoted and that the radar observer can manipulate it conveniently.

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A special flexible, permanently mounted cable connects H 3 with its cable terminal box to permit pivoting of the instrument. The terminal box can be mounted at any desired spot, but must remain readily accessible so that the fuses can be exchanged without encountering any difficulty.

2.5. T 3 ~~Daughter~~ Slave Display Unit

The entire content of Paragraph 2.4 applies for T 3.

2.6. Power Supply

The transformer is mounted in the conventional manner through vibration-damping connectors onto a sufficiently stable foundation, while the other equipment required by the power-supply system is permanently wall-mounted. The field regulator must be mounted on a wall running parallel to the longitudinal axis of the vessel.

3. Laying of Cables

When the positions at which the individual parts of the installation are to be mounted have been established, the cables specified in the connection diagram are to be laid, as follows:

For Types 1420.8 F 1 to F 3	1420.008-00001 to 00003 Bp 1 1420.008-00001 to 00006 Bp 2
For Types 1420.8 F 4 to F 6	1420.008-00004 to 00006 Bp 1 1420.008-00001 to 00006 Bp 2
For Types 1420.8 F 7 to F 9	1420.008-00007 to 00009 Bp 1 1420.008-00007 to 00012 Bp 2
For Types 1420.8 F 10 to F12	1420.008-00010 to 00012 Bp 1 1420.008-00007 to 00012 Bp 2

The cabling operation is to follow the applicable VDE- and DIN-specifications.

4. Waveguide Installation

The high-frequency energy is transferred from the transmitter to the antenna and the echo pulses are fed back through a square

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waveguide.

Since structural conditions at hand differ for each application, the waveguide train (energy conductor) must be specially fabricated in each case for adaptation to the object in question.

As we have already noted under 1.3, waveguide lengths (total length from A 3 to G 3) greater than 10 meters are not permissible, and the number of flanges and angle pieces is to be held to a minumum.

4.1. Waveguide Path

The waveguide path is to be established at the point of installation and the total length measured exactly. Then the energy conductor is to be prepared for installation in the workshop, i.e., the individual waveguide sections of which the over-all energy conductor will be composed are brought to the required dimensions, the flanges are ~~brazed~~ soldered on and finish-machined, and the necessary elbows or angle pieces are fabricated.

4.2. Structure of Energy Conductor

The entire waveguide train has the following composition:

No.	Part	Initial Flange	Terminal Flange
1.	Generator G 3	-	plus
2.	Flexible waveguide, Type 9401 (156 lg)	minus	plus
3.	Energy conductor Skz 23253-01007 (150 lg)	minus	plus
4.	Leak-test conductor Skz 23253-01011 (156 lg)	minus	plus
5.	Locally required energy conductor	minus	plus
6.	A 3 antenna	minus	-

In installing the energy conductor, it must be made certain that a plus flange is always bolted to a minus flange at the flange connections.

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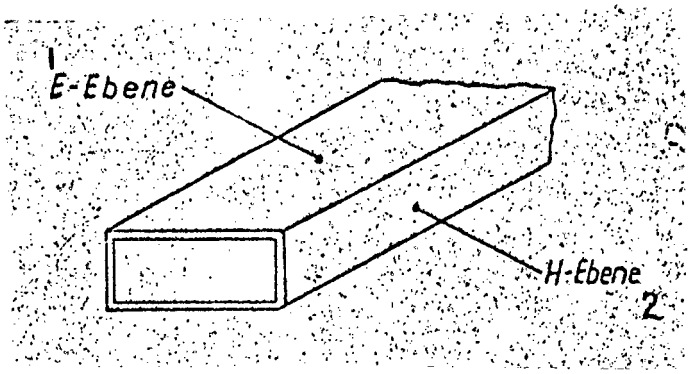
Angle Piece

The locally dictated energy conductor listed as Point 5 of the list in 4.2 may contain bends. Bends are made in the energy conductor by installing angle pieces. In making the measurements for the energy conductor, it must be determined in advance whether the waveguide is to bend in its E-plane, i.e., across the broad side of the waveguide, or in its H-plane, i.e., across its narrow side.



1) E-plane; 2) H-plane.

Then the appropriate angle pieces are to be installed. The accessory box contains one "E" angle piece [accessory list Item 7, Drawing No. Skz 23253-01041(4)]and one "H" angle piece [accessory list Item 8, Drawing No. Skz 23253-01044(4)], and these can be used in the installation. If additional angle pieces are required, these are to be ordered from Funkwerk Koepenick, as follows:

"E" angle piece — Skz 23253-01041(4)
"H" angle piece — Skz 23253-01044(4)

4.3. Sealing of the Energy Conductor

The waveguide train is to be made absolutely airtight at the antenna and at G 3 to prevent the warm air from G 3 from flowing through the waveguide train to the antenna. Otherwise, water would condense in the waveguide train as a result of the great temperature difference where the waveguide passes from the relatively warm operations room into the open air. This condensation water may, under certain circumstances, cause partial or total malfunctioning of the

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installation.

A styroflex or Perlon [nylon] foil is inserted in the flange connection between the antenna and the waveguide. This foil seals the waveguide aperture, but offers no resistance to high-frequency energy. In order that the rubber-gasket sealing on the outside (laterally) will remain effective, the plus flange of the waveguide, which is screwed to the waveguide connection of the antenna and is normally smooth, is provided with an additional channel to receive a packing ring. Thus, the foil is compressed between two rubber rings. The following part is to be employed in this phase of fabricating the energy conductor:

Flange after Drawing No. Skz 23253-02008(5).

The lower foil seal is made between the plus flange of the waveguide (Skz 23253-01007) and the minus flange of the leak-test conductor (Skz 23253-01011). The plus flange is also to be provided with an additional rubber sealing ring in this case.

4.4. Twisting the Waveguide

If the antenna is installed in accordance with Point 2.1, the narrow side of the waveguide will be facing directly ahead. In spite of all changes in the direction of the waveguide, it terminates at G 3 in the same position, i.e., the narrow side of the waveguide faces ahead, as it did in coming from the antenna. In this case, the transmitter-receiver unit G 3 must be installed in such a way that its front or rear side faces dead ahead. If, however, the installation is to be made in such a way that the narrow side of G 3 faces ahead, a torsion piece is to be inserted in the waveguide. The waveguide will be twisted through 90° as a result. These torsion pieces can be obtained from Funkwerk Koepenick.

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4.5. Waveguide

Great care must be exercised in installing the waveguide. Any change in shape on or in the waveguide will disturb the high-frequency oscillations induced in it. Thus, any other foreign body in the waveguide will give rise to disturbances, regardless of whether it is condensed water, dirt, or products of corrosion. Extremely small quantities of ~~dirt~~ these are frequently sufficient to put the installation out of commission.

The waveguide to be used is the high-frequency type produced by and available from VEB Berliner Metallhuetten und Halbzeugwerke (BMHW) (Berlin Metalworking and Semifabricate Works), Berlin-Neiderschoeneweide, Schnellerstr. 131-134. The order should read as follows:

Ms [Brass] 63 HF Square waveguide
DIN 47 302 (energy conductor)
Nominal dimensions 22 x 10
Tolerance ± 0.08

4.6. Connecting Flange

In order to connect the waveguide with the instruments or another section of waveguide, flanges are ~~brazed~~ soldered onto the waveguide ends. Care must be taken to ensure that a plus flange is always screwed to a minus flange. These flanges are to be obtained from Funkwerk Koepenick for attachment.

4.61. Minus Flange

To be obtained from Funkwerk Koepenick with reference to Drawing No. Skz 23253-02025(5) (Fig. 4).

4.62. Plus Flange (brazing only)

To be obtained from Funkwerk Koepenick with reference to Drawing No. 1077.008-00010(5) (Fig. 5).

Declassified in Part - Sanitized Copy Approved for Release 2013/01/25 : CIA-RDP80T00246A066200010001-5

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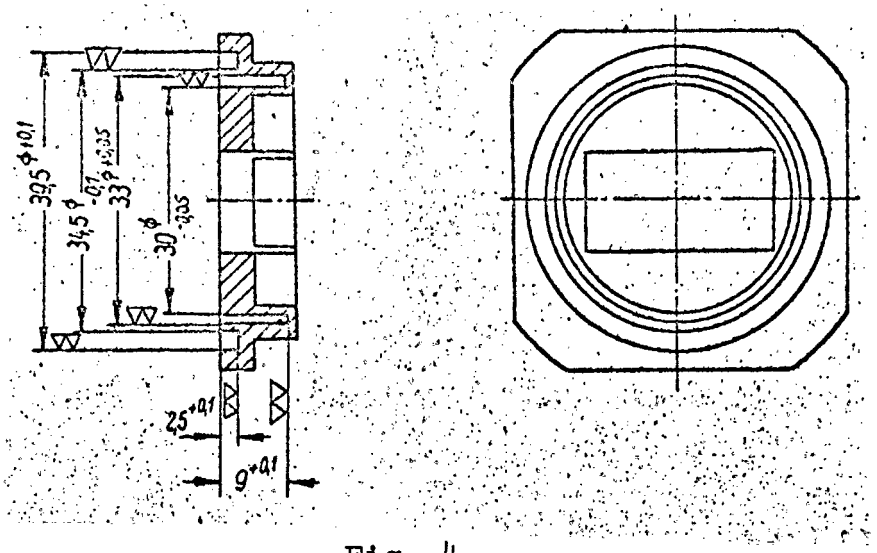
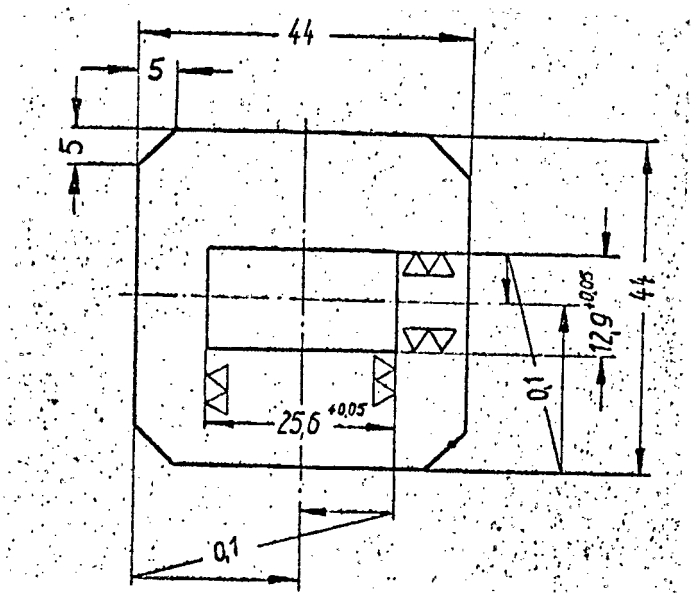


Fig. 4.



Material:
Brass plate
4 mm thick

Fig. 5.

4.63. Plus Flange (only for subsequent soft soldering)

To be obtained from Funkwerk Koepenick with reference to Drawing No. 1077,008-00002(5) (Fig. 6).

4.7. Attachment of Flanges

The flanges are to be brazed to the waveguide. Preparation of the components for brazing is of decisive significance for producing satisfactory brazed joints.

The gap at the joint to be brazed should be between 0.05 and

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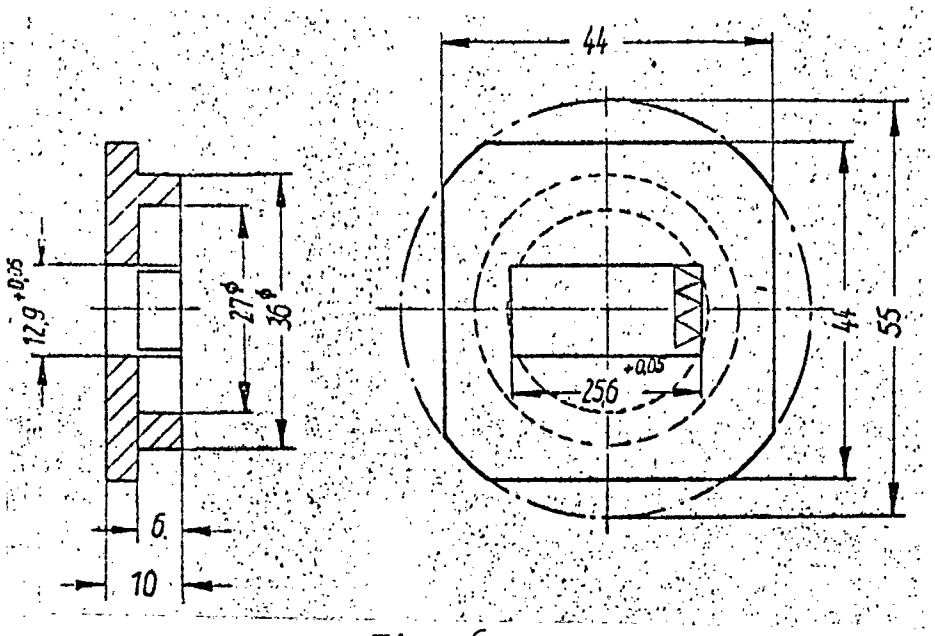

Fig. 6.

0.2 mm, and as close as possible to the lower limit. The relatively large outside tolerance of the tubes is to be taken into account. The tube surface will show a concavity if the brazing gap is too narrow (0.05 mm), and the flanges supplied are to be reworked accordingly.

*A 5-mm finishing allowance is to be provided for tube ends to which the flanges are brazed.

*The points on the tubes that are to be brazed should be brushed clean.

*The components (tube and flange) are to be ~~tensioned~~ in a brazing fixture.

*The flux is applied and the brazing metal laid over it.

Flux: Brasolin 420a; Supplier: Emil Otto, Fabrik chem.-techn.Produkte Magdeburg, Maxim-Gorki-Str. 33

Silver solder: LAg 45 after DIN 1734

*The joint to be brazed is heated uniformly and as quickly as possible (in four minutes at the longest) with a ring burner and brought up to the working temperature, which is approximately 670°C.

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Acetylene, propane, or illuminating gas should be used. The flame should be adjusted soft.

The flow time of the brazing metal is 40 to 60 seconds.

Caution! Nonuniform heating may result in collapse of the tube walls.

*After brazing, the components are to be pickled in dilute sulfuric acid (5%).

*The flanges are now to be planed; here, exactly 0.5 mm should be removed.

*In addition, the minus flanges must be sunk by exactly 0.3 mm on the surface bounded by the choke circle.

*The four holes are to be drilled in the flange with the aid of a drilling fixture. The fixture must hold the tubes from the inside.

*After the work has been completed, all apertures in the waveguide are to be closed with adhesive tape. Immediately before final installation, the adhesive tape is to be removed and the interior of the waveguide sections checked for cleanliness.

If it should be necessary to make adjustments to the waveguide train (e.g., shorten a waveguide that has already been installed) when the energy conductor is placed in position, and it is not possible to carry out brazing on the spot, soft soldering is permissible. In this case, the flanges supplied in the accessory crate (which are designed specifically for soft soldering) must be used.

The last-mentioned procedure is highly critical. The work must be carried out extremely carefully, again with a brazing fixture, so that no inpingement points are produced in the waveguide train.

Caution! Soft soldering is permissible only when the normal procedure described earlier is not possible. Deviations from precision

Declassified in Part - Sanitized Copy Approved for Release 2013/01/25 : CIA-RDP80T00246A066200010001-5

Declassified in Part - Sanitized Copy Approved for Release 2013/01/25 : CIA-RDP80T00246A066200010001-5

in the work result in energy losses.

5. Attachment of Cables to Instruments

The cables laid out in accordance with Paragraph 3 are connected to the individual instruments in the installation in accordance with the connection plans applying to the instrument type in question (see Paragraph 3).

5.1. 220/380-Volt On-Board or Local Line with Neutral Wire (50 cycles)

Phases R, S, and T are attached to terminals 1, 2, and 3 in the auxiliary line unit (Z 3) and the neutral wire to terminal 4. Terminal 5 is then to be connected with terminal 3 and terminal 6 with terminal 4.

5.2. 380-Volt, 50-Cycle On-Board Net Without Neutral Wire

Phases R, S, and T are connected to terminals 1, 2, and 3 in the auxiliary line unit (Z 3). Terminals 5 and 6 are to be supplied with 220-volt, 50-cycle current, which may be taken from a transformer (at about 200 watts).

5.3. 220-Volt (DC?) On-Board Line?

The corresponding connections diagram is to be followed in this case.

6. Connection of Installation to Local or On-Board Line

Before the current cables of the local or on-board line are connected to the installation's power-supply unit, the following preparatory measures are to be taken:

6.1. For polyphase:

The motor overload switch M6 6 (Sch 1) and the [circuit breakers] (Si 6 and Si 7) in the auxiliary line unit Z 3 are to be shut off and the range switch on H 3 is to be set to "B" (Bereitschaft: readiness).

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The hood is removed from N 3. This opens the housing contact (Sch 1) in N 3 so that the leads for the various voltages powering the installation are interrupted. (See detail drawing 1420.008-00001 to 00003 Up 1 or 1420.008-00004 to 00006 Up 1)

6.2. For Direct-Current Line:

The switch on the marine self-starter and the range switch on H 3 are shut off. The hood is removed from N 3. This opens the housing contact (Sch 1) in N 3, so that the leads for the various supply voltages to the installation are interrupted (see detail drawing 1420.008-00007 to 00009 Up 1 or 1420.008-00010 to 00012 Up 1)

6.3. Connecting Line Voltage Through to Installation

After the procedures described under 6.1 or 6.2 have been carried out, the local or on-board line can be connected through to the installation.

7. Initial Operation

7.1. Adjustment of Converter Voltage

7.1.1 For polyphase

The converter is switched on by operating the motor safety switch in Z 3.

The converter voltage (500 cycles), which should come to 115 volts, is to be measured across the terminals Ke 14 and Ke 15 in Z 3. If this value is not indicated, the voltage must be adjusted. This adjustment is made from the outside of the field regulator, using a screw driver on the set screw provided for the purpose. After the adjustment has been made, the converter is to be shut off again with the range switch, the automatic circuit breakers Si 6 and Si 7 in Z 3 are to be pushed in, and the hood replaced on N 3. Then the regulating capacity of the field regulator is to be checked.

Declassified in Part - Sanitized Copy Approved for Release 2013/01/25 : CIA-RDP80T00246A066200010001-5

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7.1.2. For direct-current line

The switch on the marine self-starter is to be set to "manual". This should start the converter.

The (500-cycle) converter voltage, which should be 115 volts, is to be measured across the terminals Ke 26 and Ke 27 in the distributor box V 3. If this way is not indicated [sic], the procedure described under 7.1.1 is to be followed further. When the adjustment has been made, the self-starter switch is set to the "automatic" position. The converter is again shut off with the range switch and the hood of N 3 replaced.

7.2. Checking Connections

After the converter voltage has been adjusted for no-load operation, the cable connections are checked to permit early detection of shortcomings.

7.2.1 In the generator (G 3)

The connection terminals are made accessible by removing the hood of G 3, which simultaneously opens the housing switch (Sch 1). The installation is switched to "readyness" (Sch 6 in H 3). The ~~daughter~~ slave display ~~device~~ unit T 3 remains out of operation for the time being. The following connections and voltages are to be checked:

Ke 2/8 against Ke 2/9	approx. 110 v
Ke 1/2 against Ke 2/9	approx. 110 v
Ke 1/4 against Ke 2/7	approx.+300 v
Ke 1/5 against Ke 2/7	approx.+230 v (no-load voltage)
Ke 2/6 against Ke 2/7	approx.-170 v

7.2.2. In terminal box for H 3

Ke 1 against Ke 3	approx. 110 v
Ke 4 against Ke 5	approx. 110 v
Ke 6 against Ke 7	Angle-data-transmitter phase

Declassified in Part - Sanitized Copy Approved for Release 2013/01/25 : CIA-RDP80T00246A066200010001-5

Declassified in Part - Sanitized Copy Approved for Release 2013/01/25 : CIA-RDP80T00246A066200010001-5

Ke 7 against Ke 8	voltage 0...115 v, depend-
Ke 6 against Ke 8	ing on position of data transmitter.
Ke 9 against Ke 15	approx. + 24 v
Ke 14 against Ke 15	approx. + 24 v
Ke 18 against Ke 17	approx. + 180 v
Ke 19 against Ke 17	approx. + 370 v (no-load voltage)
Ke 20 against Ke 17	approx. + 520 v (no-load voltage)

7.2.3. In the terminal box for T 3

Ke 1 against Ke 3	approx. 110 v
Ke 4 against Ke 5	approx + 24 v
Ke14 against Ke 15	approx. 110 v
Ke11 against Ke 12	Angle-data-transmitter volt-
Ke12 against Ke 13	age 0...115 v, depending
Ke11 against Ke 13	on position of angle transmitter.

The installation is to be shut off (Sch 6 in H 3) and the hood of G 3 replaced.

7.3. Functional Testing of H 3

7.3.1. Adjustment of image

First, the knobs for "brightness" and "contrast" are to be turned left to the stops. If the brightness is adjusted too high, the electron beam may burn through the phosphor layer within a few seconds if the beam is not rotating. Exercise great caution!

The angle-data synchronization lead is to be disconnected from Ke 10 in the H 3 terminal box and the fuse Si 1 in G 3 is to be removed in order to cut off the high voltage.

Declassified in Part - Sanitized Copy Approved for Release 2013/01/25 : CIA-RDP80T00246A066200010001-5

Declassified in Part - Sanitized Copy Approved for Release 2013/01/25 : CIA-RDP80T00246A066200010001-5

Next, the installation is switched on by turning the range switch to "B" (readiness). The ~~daughter~~ slave display unit remains out of operation for the time being. After the warmup period (about 3 minutes), the time relay in the low-voltage line unit will pull up audibly. Now the range switch is set to 24 nautical miles. This will set the antenna into rotation, and as the brightness is turned up there will appear on the H 3 image screen an electron beam deflected from the center to the margin of the screen; this must rotate clockwise. The brightness should be turned up only moderately and the beam should be focused sharply. Noise should become perceptible when the contrast is turned up. Then the installation is to be shut off and the fuse Si 1 replaced. Then the installation is switched back on with the instrument circuits closed. The image is adjusted after the warmup period and switching to one of the ranges. The contrast knob is turned to the left stop and the brightness turned up only far enough to render the scan visible. Then the contrast is adjusted in such a way that the noise is just below the visibility threshold. Now any targets that are present should become visible on the image screen without further adjustments.

7.3.2. Adjustment of dead-ahead marker

After the antenna has been mounted and adjusted in accordance with these instructions, it is necessary to take measures to make it possible to orient the image dead-ahead and align the dead-ahead mark with the zero index.

Z e r o I n d e x

The zero index is a triangular plate made from a transparent material and has a short hairline engraved into it. This index is fixed vertically above the image centerpoint at the margin and the

Declassified in Part - Sanitized Copy Approved for Release 2013/01/25 : CIA-RDP80T00246A066200010001-5

Declassified in Part - Sanitized Copy Approved for Release 2013/01/25 : CIA-RDP80T00246A066200010001-5

azimuth scale.

The dead-ahead marker is made visible by setting the "markers" switch to "V" and turning up the "marker brightness" knob. Using the knobs labeled "↕" and "↔" the beam is to be adjusted in such a way that it will rotate about the centerpoint, which is marked by crosshairs.

The next step is to take an optical bearing. A bearing is taken on a highly conspicuous target using an alidade on the bearing compass, and the angle between this target and the ship's dead-ahead direction is determined. The optical bearing is compared with the radar image and the bearing hairline engraved into the azimuth-scale disc is placed over the optically located target. Now the angle between the bearing hairline and the dead-ahead marker should correspond to the optically determined bearing angle. Differences may, of course, arise between the bearing angle and the angle read from the azimuth scale; these originate through installation errors. Errors of $\pm$ 5° can be compensated as follows:

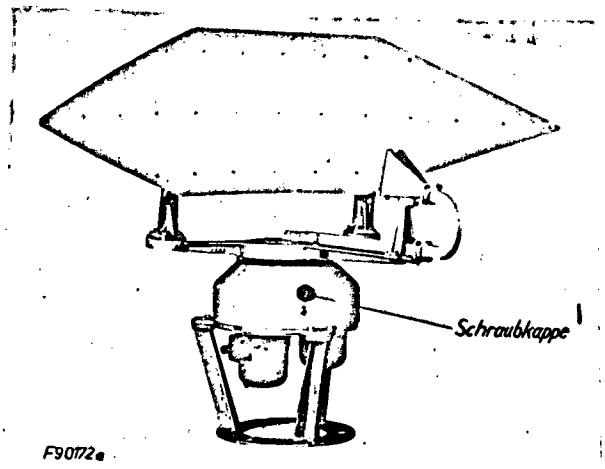

Fig. 7. 1) Screw cap.

The screw cap on the side of the antenna drive (Fig. 7) is removed. A ten-millimeter socket wrench is used to loosen the

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Declassified in Part - Sanitized Copy Approved for Release 2013/01/25 : CIA-RDP80T00246A066200010001-5

setscrew behind it, and the latter is adjusted with a screw driver to produce the optically determined angle on the image screen between the bearing hairline and the dead-ahead marker. The setscrew is relocked and the screw cap screwed back into place.

When the procedures outlined thus far have been carried out, the dead-ahead marker will stand in the proper relation to the targets displayed by the radar image, but will not indicate them "right-side up," as we should expect, but in some random direction. This is why we now set the "image orientation" switch to "V" and pull the "image erection" knob out of its lock. When this knob is turned, the entire image, including the dead-ahead marker, rotates too, and is turned until the dead-ahead marker stands under the zero index. It may happen that the image will come to a stop during rotation before the zero index has been reached. In this case, the "image orientation" switch is to be set to "N," rotation continued briefly, the switch reset to "V," and the rotation continued until the dead-ahead marker stands under the zero index.

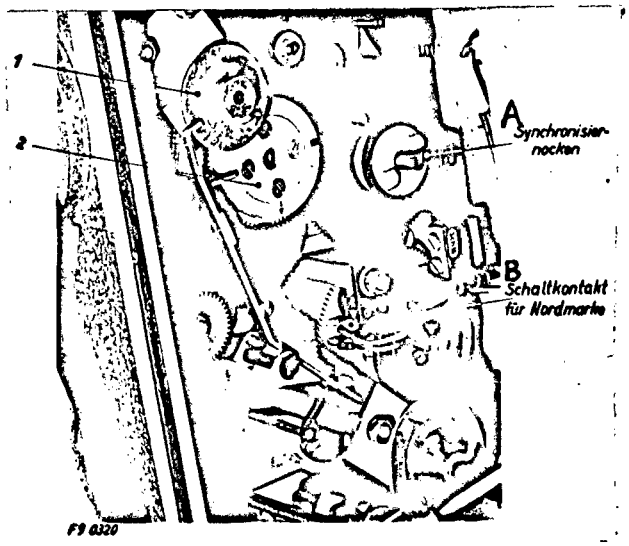

Fig. 8. A) Synchronization cam; B) switch contact for north marker.

The installation is now switched on, the front and rear hoods

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Declassified in Part - Sanitized Copy Approved for Release 2013/01/25 : CIA-RDP80T00246A066200010001-5

of H 3 removed, and the two housing contacts jumpered. The instrument is switched on again.

Caution, High Voltage!

The two stop discs 1 and 2 (Fig. 8) are to be loosened and turned until the levers click into position. The stop discs are then tightened. The installation is again shut off.

7.3.3. Synchronization of the angle-data transmission system between A 3 and H 3

The angle-data transmitter synchronization lead is to be reconnected to terminal Ke 10 in the H 3 terminal box and the screening cap of the angle-data transmitter is removed (handle carefully; mu-metal).

H 3 has a switch cam which operates the synchronization contact (Fig. 8), i.e., closes it. The adjustment has been made in such a way that the contact remains closed during an antenna sweep of 16° ± 1°. If the synchronization contact stands at the center of the switch cam, the graduation on the shaft of the Dm 2 data unit (Fig. 9) should point to the data-unit connection "y" (center of knife-switch blade).

If this is not the case, the headless screws on the switch cams are to be loosened and shifted far enough to produce the state described above. The headless screws are again tightened down. Now the installation is switched on again. The synchronization should "catch" properly when the antenna starts to rotate. If further difficulties arise, the installation of the data unit in the antenna should be checked.

The antenna-drive housing has a synchronization contact whose switching angle is 18° ± 1°. When the contact stands at the center of the cam lobe, the indicator on the end of the data-unit

Declassified in Part - Sanitized Copy Approved for Release 2013/01/25 : CIA-RDP80T00246A066200010001-5

Declassified in Part - Sanitized Copy Approved for Release 2013/01/25 : CIA-RDP80T00246A066200010001-5

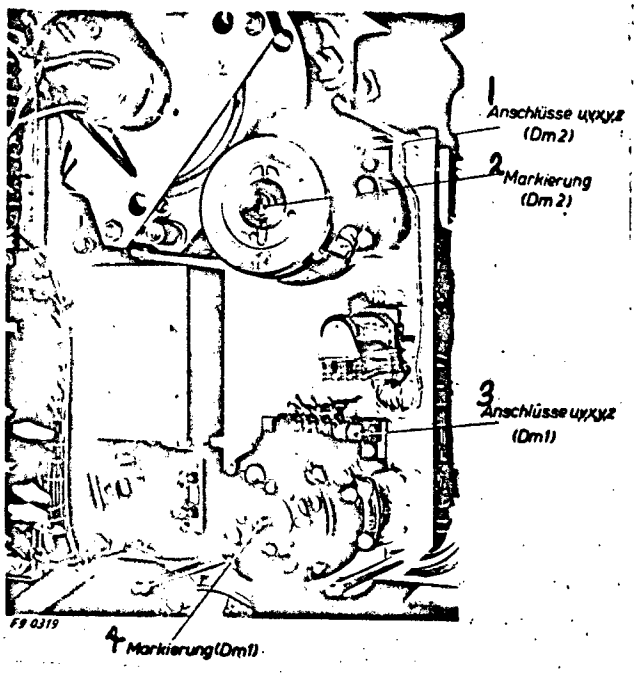


Fig. 9. 1) u,v,x,y and z terminals (Dm 2); 2) indicator (Dm 2); 3) u,v,x, y, and z terminals (Dm 1); 4) indicator (Dm 1).

shaft should point in the direction of the "y" terminal of its plug connection. If this is not the case, the data unit must be removed, the gear turned accordingly, and the data unit reinstalled.

7.3.4. North orientation of image

North orientation of the image is possible only if the installation can be coupled to a gyro compass. The "markers" switch is set to "N+V." Both markers will now be visible on the image. The north marker is a broken line so that it can be distinguished from the dead-ahead marker. To the right of the course counter, there is a hole in the front plate into which a (crank-type) calibrating wrench is inserted. This wrench will be found in the accessory box. It is used to turn the north marker until it coincides exactly with the dead-ahead marker. The wrench must be left in position! The counter coupling is disengaged and the counter set to 000. Then the coupling is remeshed. The next step is to turn the wrench until the counter reading agrees with the compass course. The calibrating wrench is then removed.

Declassified in Part - Sanitized Copy Approved for Release 2013/01/25 : CIA-RDP80T00246A066200010001-5

Declassified in Part - Sanitized Copy Approved for Release 2013/01/25 : CIA-RDP80T00246A066200010001-5

When the calibrating wrench is pulled out, the angle-data unit – and with it the counter – jump to a value that deviates slightly from the compass course (by ± 1° at most). To make the correction, the angle-data cap is again removed and the compass data unit (Dm 1) (Fig. 9) is dismounted. After loosening the five screws, the cross-staff head snap coupling is to be turned in such a way that the course will be indicated correctly after it has been properly locked with the data unit installed. Then the data unit is again tightened ~~down~~ and the cap replaced. The housing contacts are freed and the instrument is closed ~~up~~.

7.4. Functional Testing of T 3

7.4.1. Adjustment of image

The synchronization lead is to be disconnected from terminal Ke 16 in the terminal box of T 3. T 3 is opened and the housing contacts ~~jumpered~~ bridged. All knobs are turned left ~~to their limits~~ all the way and the instrument is set to "readiness." After a warmup time of about three minutes, the 24-nautical-mile range is cut in. The background brightness "☼" is turned up until the beam barely becomes visible, followed by sharp focusing ("⊙") and turning the "contrast" knob up until any available targets are easily recognizable.

7.4.2. Synchronization of angle-data unit

The "dead-ahead-marker/distance rings" switch is set to "V+E" and the "marker-brightness" knob turned up until the dead-ahead marker appears. It is now necessary to determine the angle between the zero index and the dead-ahead marker on the azimuth scale. H 3 is set to readiness. After loosening the locking screws of the countershaft gear (Fig. 10), the deflection coil is turned through the predetermined angle and the gear retightened.

Declassified in Part - Sanitized Copy Approved for Release 2013/01/25 : CIA-RDP80T00246A066200010001-5

Declassified in Part - Sanitized Copy Approved for Release 2013/01/25 : CIA-RDP80T00246A066200010001-5

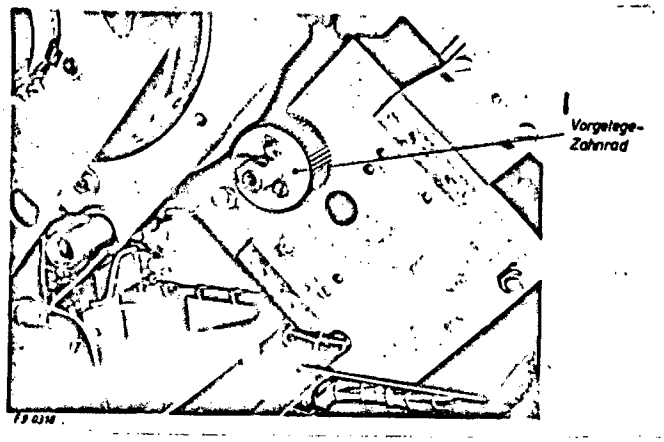


Fig. 10. 1) Countershaft gear.

H 3 is again set to any desired range and a check is made to determine whether the dead-ahead marker is exactly under the zero index. If this is not the case, H 3 is again set to readiness and the fuse Si 1 in the H 3 terminal box is removed. The beam on the image must be set exactly to 99° by turning the deflection coil. Next, the switch cam for the synchronization contact is to be loosened and turned until the contact stands exactly on the middle of the cam lobe. The cam is then retightened. The switching angle should come to 16° ± 1°.

The synchronization lead is to be reattached to terminal Ke 16 in the T 3 terminal box, the fuse Si 1 is replaced in the terminal box of H 3, and H 3 is set to a range. The relay armature (Rs 1) must be gently prodded to verify that operation will no longer occur; otherwise, the cam must be readjusted slightly. Synchronization should now occur properly. The housing contacts are freed and the instrument closed up.

7.5. Functional Check of Entire Installation

The hood is removed from N 3 and the housing contacts bridged. The final transformer-voltage adjustment is made with the Master and

Declassified in Part - Sanitized Copy Approved for Release 2013/01/25 : CIA-RDP80T00246A066200010001-5

Declassified in Part - Sanitized Copy Approved for Release 2013/01/25 : CIA-RDP80T00246A066200010001-5

Slave
~~daughter~~ display units cut into operate in the 24-nautical-mile range. The voltage across the terminals Ke 3/19 and Ke 3/20 of N 3 should be 110 volts. The following additional measurements are yet to be made on N 3:

Ke 1/4	against	Ke 1/7	+300 v
Ke 1/5	"	Ke 1/7	1/
Ke 1/6	"	Ke 1/7	1/
Ke 5/29	"	Ke 5/30	1/
Ke 5/31	"	Ke 5/30	+180 v
Ke 5/32	"	Ke 5/30	1/
Ke 5/33	"	Ke 5/30	+470 v (in the 24-nautical-mile range)

1/: These values are to be taken from the test-procedure instructions attached to the installation.

The effectiveness of the sea-clutter suppression circuit will vary as a function of antenna height and antenna-mount location. The resistors W 1 and W 2 are dimensioned at 20 kilohms at the "sea-clutter suppression" switch.

If sea-clutter suppression should be found inadequate, these resistors are to be replaced by others with smaller values. However, no resistors below 5 kilohms should be used. It is necessary to exercise caution so as not to suppress nearby targets unintentionally by adjusting the sea-clutter suppression too high.

Declassified in Part - Sanitized Copy Approved for Release 2013/01/25 : CIA-RDP80T00246A066200010001-5

Declassified in Part - Sanitized Copy Approved for Release 2013/01/25 : CIA-RDP80T00246A066200010001-5

II

Declassified in Part - Sanitized Copy Approved for Release 2013/01/25 : CIA-RDP80T00246A066200010001-5

Declassified in Part - Sanitized Copy Approved for Release 2013/01/25 : CIA-RDP80T00246A066200010001-5

OPERATING INSTRUCTIONS

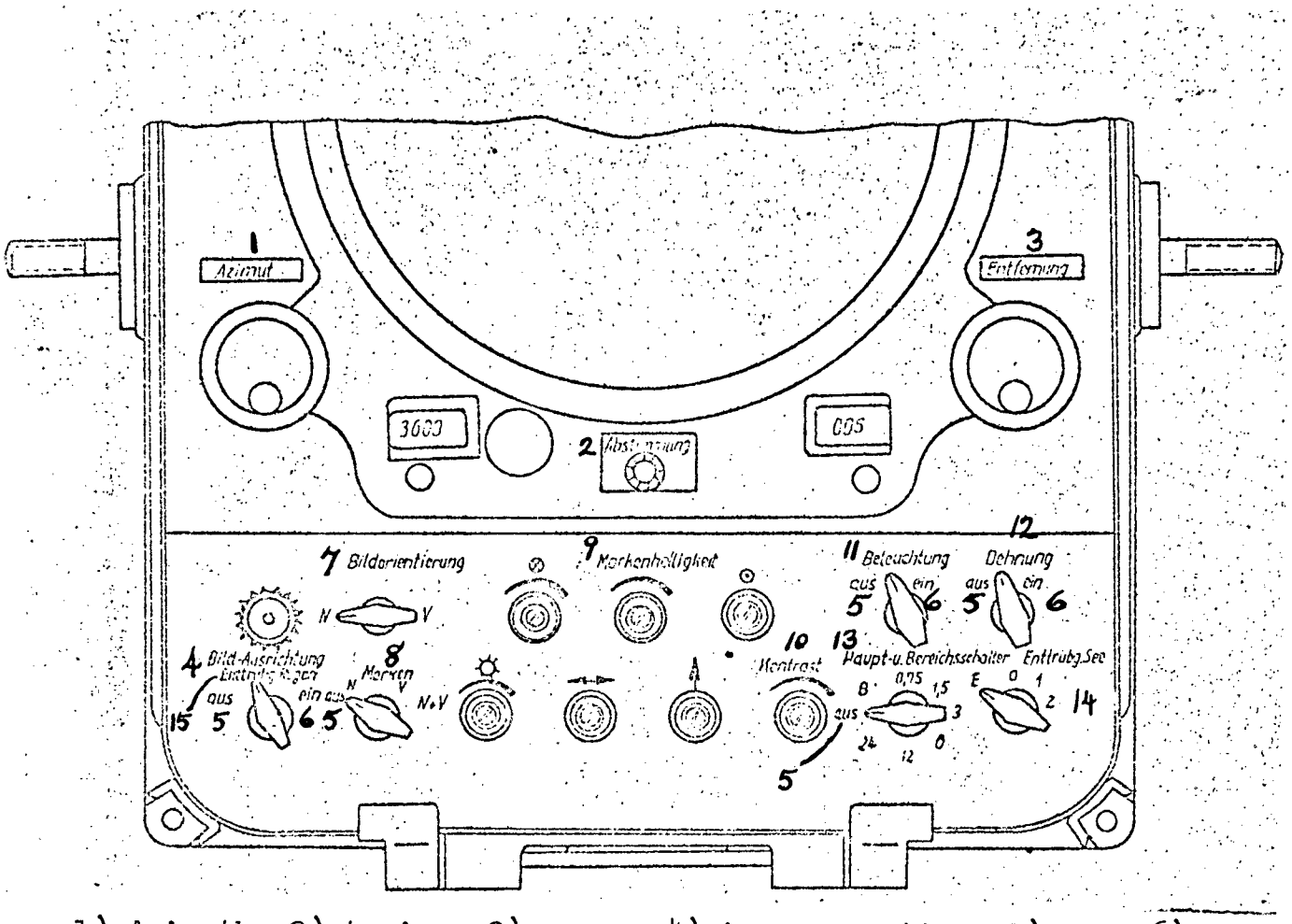
~~TABLE OF CONTENTS~~

GP/...

Declassified in Part - Sanitized Copy Approved for Release 2013/01/25 : CIA-RDP80T00246A066200010001-5

Declassified in Part - Sanitized Copy Approved for Release 2013/01/25 : CIA-RDP80T00246A066200010001-5

The entire installation is operated from the main display unit (H 3). All knobs and switches necessary for operation are located on the front plate of H 3. All knobs and switches should



1) Azimuth; 2) tuning; 3) range; 4) image erection; 5) off; 6) on; 7) image orientation; 8) markers; 9) marker brightness; 10) contrast; 11) illumination; 12) dilation; 13) main and range switch; 14) sea-clutter suppression; 15) rain-clutter suppression.

be set to "off" or at their left stops before the device is placed in operation.

1. Switching the Instrument on

The first step in placing the installation in operation is to turn the range switch to position "B" (readiness). This starts

Declassified in Part - Sanitized Copy Approved for Release 2013/01/25 : CIA-RDP80T00246A066200010001-5

Declassified in Part - Sanitized Copy Approved for Release 2013/01/25 : CIA-RDP80T00246A066200010001-5

the converter, and all of the installation's tubes with the exception of those in the daughter display unit (T 3) are heated up. The required operating voltages are blocked by a thermal time relay during the warmup period. After about three minutes, the time relay pulls up and the installation is ready for operation. Now the range switch is set to the desired distance range, at which point the antenna begins to rotate.

2. Adjustment of Screen Image

The background brightness, which is keyed by the symbol "☼", is adjusted until a bright line (radius) ~~makes its~~ appearance and rotates about the image center point on the screen. The knob "⊙", is then used to focus the rotating beam sharply. Any targets present should then become visible when the "contrast" knob is turned.

The "tuning" knob is to be touched only when the automatic system of the fine-tuning amplifier is shut off and the switch 2 under the housing of G 3 is set to position 2 (hand tuning). A more detailed discussion of this point will be found in the maintenance instructions, Paragraph 3.2.

3. Marker Brightness

The brightness of the following markers is adjusted from zero to maximum brightness by turning the "marker brightness" knob:

1. Dead-ahead marker
2. North marker
3. Variable distance-measurement circle

4. Measurements

4.1. Measurement of Azimuth

If it is necessary to measure the azimuth of an object, the scale illumination is first switched on with the "illumination" switch and the knob "⊗" turned until the degree scale on the

Declassified in Part - Sanitized Copy Approved for Release 2013/01/25 : CIA-RDP80T00246A066200010001-5

Declassified in Part - Sanitized Copy Approved for Release 2013/01/25 : CIA-RDP80T00246A066200010001-5

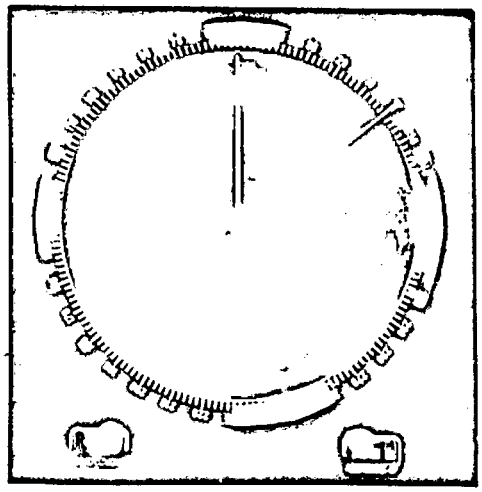


Fig. 1.

margin of the image tube is easily visible. Then the image centerpoint is brought exactly beneath the centerpoint of the degree scale as marked on the disc, by operating the two knobs " ↕ " and "←→". This positioning is to be checked before every measurement, since the Earth's magnetic field may cause displacement of the image. The "azimuth" knob is used to bring the bearing hairline of the scale over the blip to be measured. The measured value is read above the zero index. (Fig. 1).

The zero index is a plate made of a transparent material with a short hairline engraved onto it to provide an exact indication of the "null" point. This index is permanently positioned vertically above the image centerpoint at the margin and over the azimuth scale.

4.2. Distance Measurement

The "distance" knob can be manipulated to place the variable scale circle over the target whose range is to be measured. The distance in nautical miles is read from the counter (Fig. 2).

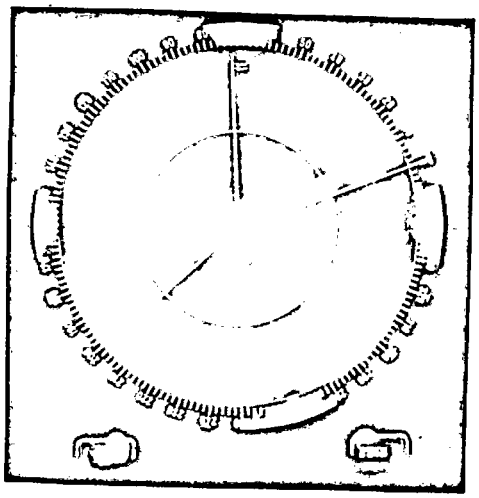


Fig. 2.

5. Marker Fadein

5.1. Dead-Ahead Marker

The dead-ahead marker is a radial line which coincides with the zero index when the installation is

Declassified in Part - Sanitized Copy Approved for Release 2013/01/25 : CIA-RDP80T00246A066200010001-5

Declassified in Part - Sanitized Copy Approved for Release 2013/01/25 : CIA-RDP80T00246A066200010001-5

oriented dead-ahead if the drive has been locked with the image dead-ahead oriented. The dead-ahead marker appears on the image screen when the "markers" switch has been set to position "V" (dead ahead) and can be varied by operating the "marker brightness" knob.

5.2. North Marker

If the "marker" switch is set to position "N" (North), a radial line, the so-called north marker, will be similarly inscribed on the image screen. It is made visible as a broken line to permit distinguishing it from the dead-ahead marker. If the radar installation is coupled with a gyrocompass, the north marker will point exactly north if the image has been north-oriented. Here, however, care must be taken to ensure that the course counter (at the left below the image screen) indicates exactly the value given by the compass. If this is not the case, the counter must be readjusted with a special wrench (crank), which will be found in the accessory box. This must be rechecked every time the installation is placed in operation.

If the "markers" switch is turned to the "N+V" position, both the dead-ahead and north markers will appear on the image screen.

6. Image Orientation

6.1. North Orientation

If the image is to appear north-oriented, the "image orientation" knob is to be set to "N" (North). Then the "image erection" knob is to be pulled out and turned until the north marker comes to rest under the zero index. Then the knob is pushed in again.

6.2. Dead-ahead Orientation

If it is desired to have the image dead-ahead oriented, the "image orientation" knob is set to "V" (dead ahead); the "image erection" knob is pulled out and turned until it drops into a click

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Declassified in Part - Sanitized Copy Approved for Release 2013/01/25 : CIA-RDP80T00246A066200010001-5

stop. The dead-ahead marker should now stand under the zero index. Then the knob is pushed in again.

7. Null-Point Dilation

For close-range work (0.75 nautical mile), the image centerpoint (zero point) can be expanded to a circle to permit better definition of targets very close to the image centerpoint. The

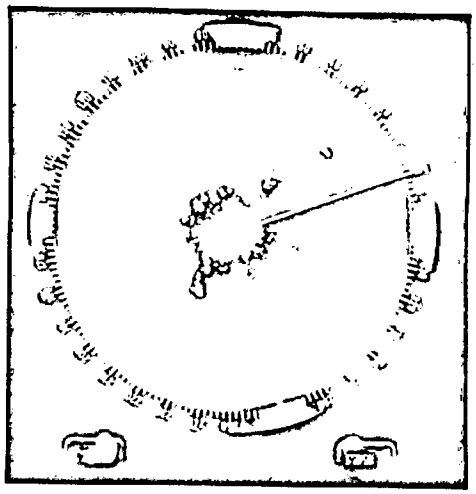


Fig. 3a

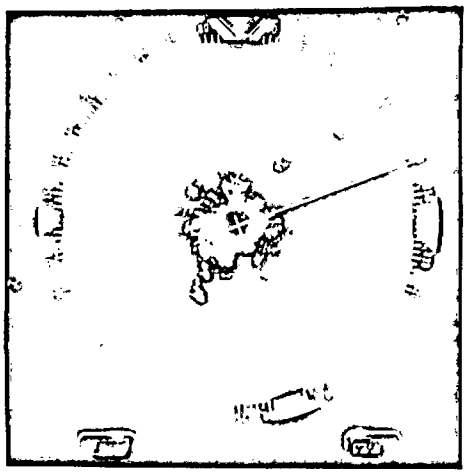


Fig. 3b

"dilation" switch is operated for this purpose. However, this switch does not lock into position, but springs back to its original position when released, so that the zero-point dilation is automatically cancelled (Figs. 3a and 3b).

8. Sea-Clutter Suppression

If ~~sea swells~~ Heavy Sea gives rise to interference by setting up strong reflections at close range, these can be reduced by operating the "sea-clutter suppression" switch.

The switch has four positions: E + 0 + 1 + 2. Position E is used only when an echo box is available and is to be placed in operation. No sea-clutter suppression occurs in position 0. Position 1 is used for moderate sea clutter and position 2 for strong clutter. The switch does not lock into position 2, however, but

Declassified in Part - Sanitized Copy Approved for Release 2013/01/25 : CIA-RDP80T00246A066200010001-5

Declassified in Part - Sanitized Copy Approved for Release 2013/01/25 : CIA-RDP80T00246A066200010001-5

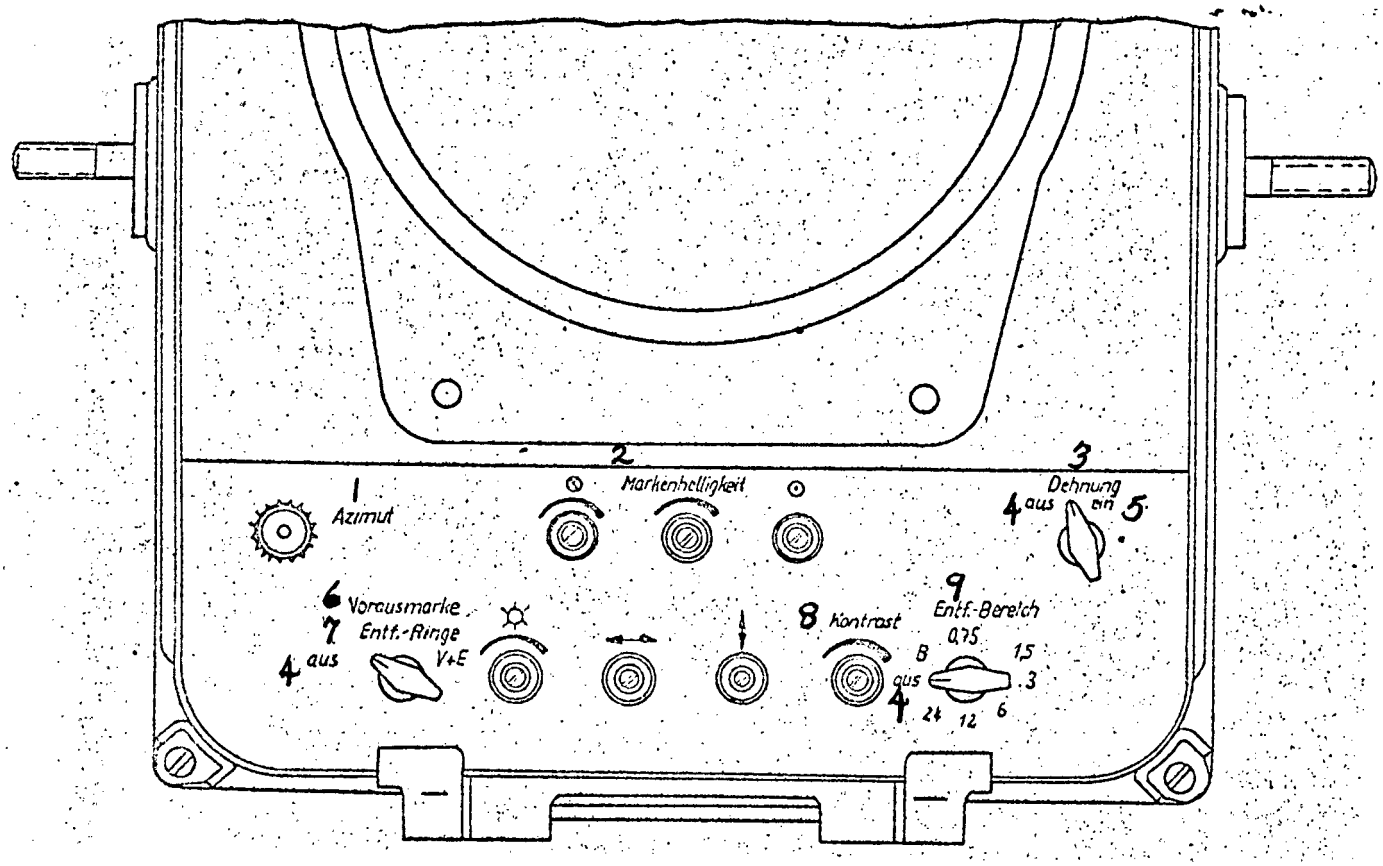
springs automatically back to position 1 when released. This measure is necessary to prevent nearby targets from being suppressed unintentionally for long periods.

9. Rain-clutter Suppression

If the targets displayed on the image screen are obscured by rain echoes, the "rain-clutter suppression" switch is operated.

10. Operation of ~~Daughter~~ Slave Display Unit

If supplied, the ~~daughter~~ slave display unit is operated independently of the main display unit. Operation of the ~~daughter~~ slave display unit presupposes that the over-all installation has already been placed in operation from the main display unit and that the thermal time relay has pulled up.



1) Azimuth; 2) marker brightness; 3) dilation; 4) off; 5) on; 6) dead-ahead marker; 7) distance rings; 8) contrast; 9) distance range.

Declassified in Part - Sanitized Copy Approved for Release 2013/01/25 : CIA-RDP80T00246A066200010001-5

Declassified in Part - Sanitized Copy Approved for Release 2013/01/25 : CIA-RDP80T00246A066200010001-5

Unlike H 3, T 3 has its own low-voltage line unit to supply the instrument with the necessary heating and other operating voltages.

To place T 3 in operation, the range switch is first set to "readiness." The tubes heat up with the switch in this position. After about one minute, the desired range can be switched in. The following controls and switches are available on the front plate of T 3, as in the case of H 3:

Distance ranges, dead-ahead marker, background brightness, image sharpness, contrast, marker brightness, and scale illumination.

Unlike H 3, which has a variable measurement circle, T 3 is provided with fixed distance rings that can be switched on or off as desired.

The brightness of the distance-measurement rings is similarly regulated by operating a "marker brightness" knob.

It is not possible to provide a north marker and north orientation of the image for T 3, since the gyrocompass can be coupled only with H 3.

Similarly, T 3 lacks the control for hand-tuning the installation. This can be done only from H 3.

The sea-and rain-clutter suppression functions are also operated only from H 3. If the range switch is again turned "off" from T 3, only T 3 is put out of operation.

11. Shutting the Installation Down

If a slave display unit is supplied, this is turned off first. Then the H 3 range switch is set to the "off" position. This shuts down the entire installation.

12. Operational Malfunctions

Should the installation malfunction during operation, the in-

Declassified in Part - Sanitized Copy Approved for Release 2013/01/25 : CIA-RDP80T00246A066200010001-5

Declassified in Part - Sanitized Copy Approved for Release 2013/01/25 : CIA-RDP80T00246A066200010001-5

structions of Paragraph 7 (first operation) and Paragraph 3 of the maintenance instructions (tube changes) should be consulted.

Declassified in Part - Sanitized Copy Approved for Release 2013/01/25 : CIA-RDP80T00246A066200010001-5

Declassified in Part - Sanitized Copy Approved for Release 2013/01/25 : CIA-RDP80T00246A066200010001-5

III

Declassified in Part - Sanitized Copy Approved for Release 2013/01/25 : CIA-RDP80T00246A066200010001-5

Declassified in Part - Sanitized Copy Approved for Release 2013/01/25 : CIA-RDP80T00246A066200010001-5

MAINTENANCE INSTRUCTIONS

TABLE OF CONTENTS

Declassified in Part - Sanitized Copy Approved for Release 2013/01/25 : CIA-RDP80T00246A066200010001-5

Declassified in Part - Sanitized Copy Approved for Release 2013/01/25 : CIA-RDP80T00246A066200010001-5

Maintenance Instructions

The following maintenance procedures must be carried out to the letter in order to guarantee that the installation will be ready for operation at all times. No guarantee claims will be accepted if the prescribed measures are overlooked.

Certain individual components in the installation have limited service lives. This applies particularly to the tubes. For this reason, Paragraph 2 lists operating times after which parts are to be replaced.

1. General Instructions

+ Tubes must be loosened very carefully from their mounts.

+ If replacing a tube in an instrument does not eliminate the malfunction, the original tube must be replaced after the trouble has been eliminated.

+ If there is reason to doubt that a tube is defective, it should, if possible, be tried out in another unit of the installation which is known to be in good working order and which uses the same tube type. If the tube is still useful, it is replaced in its original mount.

+ Coils or oscillatory circuits should not be trimmed without thorough familiarity with their functioning and without the appropriate test instruments.

+ A burned-out fuse generally indicates overloading as a result of a defective individual component.

+ When a new fuse is inserted, care should be taken to see that it has the proper value. No attempts should ever be made to eliminate

Declassified in Part - Sanitized Copy Approved for Release 2013/01/25 : CIA-RDP80T00246A066200010001-5

Declassified in Part - Sanitized Copy Approved for Release 2013/01/25 : CIA-RDP80T00246A066200010001-5

trouble by inserting stronger fuses. This will only aggravate the damage.

+ In the tropics, damage frequently occurs inside the installation as a result of the insulation materials being attacked by bacteria. The most important preventive measure is to keep the equipment dry.

+ When delivery of the installation is accepted, care should be taken to see that the spare and accessory components were packed cushioned in moisture-proof containers. It is up to the ship's command to provide competent storage. By "competent" we mean that the spare and accessory components must be kept dry and not stored in the vicinity of current-carrying cables (particularly in the cases of tubes and crystals).

+ Attention should be paid to the safety regulations and the manufacturer's instructions in replacing defective ~~design elements~~ components (e.g., image tubes).

+ The collectors or commutators of the machines are to be kept cleaned of carbon dust at all times. The collector surfaces must have a polished appearance and uniform coloration and be free of irregularities.

+ Carbon brushes must be able to move freely in their guides. When new carbon brushes are installed, they must be ground to the collector, using fine corundum cloth or fine glasspaper (no emery paper!). It should be made certain that the proper carbon-brush types are being installed.

+ The brush springs must exert constant pressure against the brushes and move with them.

+ Screws exposed to the open air are to be kept greased so that it will be easier to loosen them at later dates.

Declassified in Part - Sanitized Copy Approved for Release 2013/01/25 : CIA-RDP80T00246A066200010001-5

Declassified in Part - Sanitized Copy Approved for Release 2013/01/25 : CIA-RDP80T00246A066200010001-5

2. Maintenance of Installation

The following procedures are to be followed after the prescribed periods have elapsed:

2.1. At Daily Intervals

The crystal currents of both crystal pairs (OA 513 silicon diodes) are to be checked with the test device included in the accessory box when the installation is placed in operation. The value adjusted when the installation was placed in operation for the first time should not vary. Defective crystals are to be replaced in pairs.

2.2. After 300 Hours of Operation

Tube replacements:	Magnetron	730	1)	2)
	Klystron	723 A/B		2)
	Blocking Tubes	1 B 24	1)	2)

1) The tube manufacturer guarantees them for a storage period of one year.

2) The tube manufacturer guarantees the tubes for service lives of 300 operating hours.

2.3. After 1000 Hours of Operation

The image tubes in the display units are to be replaced (take note of safety procedure). The deflection system is to be adjusted and all voltages checked. The variable distance-measurement circle in H 3 and the constant distance rings in T 3 are to be recalibrated (Ms-10 calibrating signal generator, OG 1-8 pulse oscillograph).

2.4. After 2000 Hours of Operation

Major Overhaul of Installation

The general-overhaul operation should be carried out only by a shop that has been authorized by the manufacturer to service customers. ~~For~~ In the jurisdiction of the German Democratic Republic, this

Declassified in Part - Sanitized Copy Approved for Release 2013/01/25 : CIA-RDP80T00246A066200010001-5

Declassified in Part - Sanitized Copy Approved for Release 2013/01/25 : CIA-RDP80T00246A066200010001-5

is VEB Fernemelde-Anlagenbau Rostock (Rostock Telecommunications Equipment).

All of the prescribed checks, measurements, and calibrations are to be carried out in accordance with the test instructions for this installation.

2.4.1. Mechanical Overhaul

The mounts [suspensions] of all instruments are to be checked.

The instruments are to be checked for loose screws and nuts.

An inspection should be made to locate mechanical damage to individual components, particularly moving components.

The compound connections of all shielded cable are to be checked for tight seating.

2.4.2. Electrical Overhaul

General

Dust and other foreign bodies are to be removed from the individual components and the wiring, and especially from parts carrying high voltages.

Transmitter-Receiver Unit G 3:

Replace all tubes,

Check intermediate-frequency amplifier,

Check fine-tuning amplifier,

Check high voltage,

Measure all voltages,

Balance oscillator,

Measure transmitted power,

Check pulse repetition rate and pulse duration.

Low-Voltage Line Unit N 3:

Replace all tubes,

Measure all voltages,

Declassified in Part - Sanitized Copy Approved for Release 2013/01/25 : CIA-RDP80T00246A066200010001-5

Declassified in Part - Sanitized Copy Approved for Release 2013/01/25 : CIA-RDP80T00246A066200010001-5

Adjust electronic control components,

Check pulse repetition rate and pulse duration at master oscillator.

Main Display Unit H 3:

Replace all tubes,

Check time-sweep oscillator,

Calibrate distance circle,

Adjust marker brightness,

Check knife contacts of angle-data unit,

Check all contacts,

Measure all voltages,

Lubricate drive with special lubricant.

Slave
~~Daughter~~ Display Unit T 3:

Procedure same as for H 3.

Directional Antenna A 3:

Check knife contacts of angle-data unit,

Check all contacts,

Lubricate ball bearings with special lubricant,

Check seal of primary radiator and, if necessary, remove dirt with soft cloth,

Reflector is not to be painted but only cleaned with cloth.

Power Supply:

Lubricate transformer bearings,

Check all contacts,

Measure and readjust generator voltage,

Check field-regulator functioning.

Finally, a function-testing procedure lasting several hours is to be undertaken. Spare parts that have been used must be replaced.

Declassified in Part - Sanitized Copy Approved for Release 2013/01/25 : CIA-RDP80T00246A066200010001-5

Declassified in Part - Sanitized Copy Approved for Release 2013/01/25 : CIA-RDP80T00246A066200010001-5

3. Tube Replacement

When the tubes are to be changed, special instructions must be followed regarding replacement of the magnetron, the klystron, and the blocking tubes. Normally, the above tubes are all replaced at the same time, i.e., as a set.

3.1. Changing the Magnetron

In loosening the screws by which the magnetron is mounted, the screw driver should be manipulated carefully since the strong magnetic field tends to attract it. Wristwatches should be removed before proceding with this operation. If possible, a bronze screw driver should be used. After the complete set (magnetron, klystron, and blocking tubes) has been replaced, the installation is to be switched on.

When the magnetron is stored for long periods, it frequently occurs that sporadic overshoots (splash) arise in the magnetron and exert back effects on the keying tube as well. If the overshoots do not cease after about 10 minutes, or if the fuse Si 2 in G 3 fails, the high voltage must be reduced. This is done by unsoldering the flexible connection at the high-voltage transformer Tr 1 in the 12-kilovolt line unit and soldering it to the next higher terminal. If the overshoots still do not disappear after resoldering, the connection must be resoldered again to the terminal having the next higher label. This results in a further reduction of the high voltage on the secondary side of the transformer.

The keying current is to be measured with the test instrument in the accessory box after about three hours of operation. For this purpose, the test instrument is put into the jack provided in G 3 and its switch set to position "I_T". The keying cur-

Declassified in Part - Sanitized Copy Approved for Release 2013/01/25 : CIA-RDP80T00246A066200010001-5

Declassified in Part - Sanitized Copy Approved for Release 2013/01/25 : CIA-RDP80T00246A066200010001-5

rent should come to 30 to 40 μa. If the keying current is below this level, the flexible connection at the high-voltage transformer is to be placed on the next-lower terminal. The process is to be repeated until the required keying current has been reached. Occasional overshoots are of no importance.

3.2. Changing the Klystron

The installation must be operated for at least fifteen minutes before the klystron can be tuned. First, the switch Sch 2 under the housing of G 3 is set to position 2 (hand tuning). The "tuning" knob on the front plate of H 3 is brought to its central position.

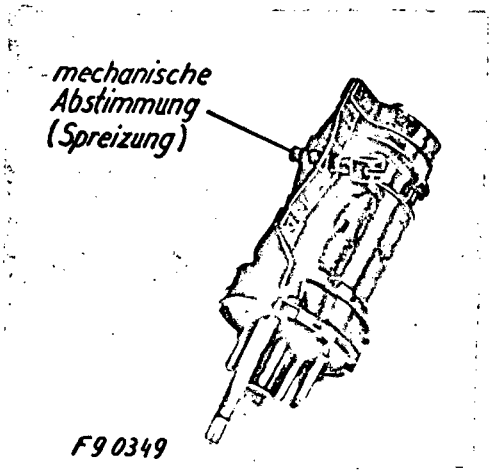


Fig. 1. 1) Mechanical tuning (spreading).

The crystal current is adjusted to its maximum with the potentiometer W 20 at the fine-tuning amplifier. The test-instrument dial is read with its switch set on "Kr. Nst." [Crystals, fine-tuning amplifier]. At this point, the klystron is trimmed mechanically enough to obtain the optimum image. It is to be remembered in this tuning operation that there are two positions at which an optimum image appears. The adjustment which requires the greater spread in the fine-tuning mechanism (Fig. 1) is to be

Declassified in Part - Sanitized Copy Approved for Release 2013/01/25 : CIA-RDP80T00246A066200010001-5

Declassified in Part - Sanitized Copy Approved for Release 2013/01/25 : CIA-RDP80T00246A066200010001-5

selected. The mechanical tuning operation is done with an insulated square-end wrench that will be found in the tool case in the accessory box.

> This mechanical tuning operation is not to be regarded as "manipulation of a control," but is done only once so that no damage can occur as a result of material breakage.

A t t e n t i o n :

The Klystron Housing is at

+ 300 v!

During mechanical tuning of the klystron, the crystal current at the potentiometer W 20 is to be held at its maximum deflection by continuous readjustment. When optimum image and maximum crystal current coincide, the switch Sch 2 under the housing of G 3 is to be set to position 1 (automatic tuning). The crystal current and image should undergo no change when this switch is made. If changes are detected, the adjustment shim W 17 at the fine-tuning amplifier is to be pushed all the way in after loosening the ~~headless~~ set screw. It is then pulled out again until the fine-tuning amplifier "catches," i.e., until the crystal current, which oscillated periodically during the hunting phase, remains constant on attaining its maximum value.

The high-frequency current of the klystron is to be set to its nominal value of 30 to 40 µa with the resistance foil W 14 in the intermediate-frequency amplifier. This value is read from the test instrument with the switch in its "Kr. Nst." position. When crystals (OA 513 silicon diodes) from VEB Werk fuer Bauelemente der Nachrichtentechnik [Plant for ~~Design~~ Components for Communications Engineering] in Teltow are used, the difference in the deflection on switching the test-instrument switch from "Kr. Nst." to "Kr. Zf"

Declassified in Part - Sanitized Copy Approved for Release 2013/01/25 : CIA-RDP80T00246A066200010001-5

Declassified in Part - Sanitized Copy Approved for Release 2013/01/25 : CIA-RDP80T00246A066200010001-5

may amount to no more than ±10 scale divisions. If the difference is larger, the crystal pair giving rise to the lower current reading is to be replaced.

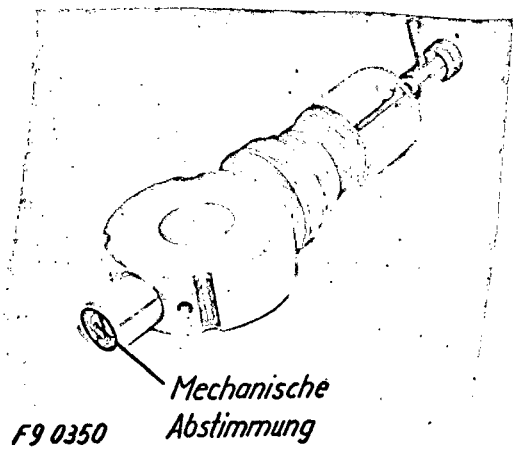


Fig. 2. 1) Mechanical tuning.

3.3. Replacement of Blocking Tubes

The blocking tubes are adjusted by mechanical tuning to produce the optimum image. The adjustment is made using a screwdriver on the screw at the base of the blocking tube (Fig. 2).

The receiver blocking tube (Ro 3) is tuned first and the transmitter blocking tube (Ro 4) second.

C a u t i o n !

When the receiver blocking tube is replaced, it is absolutely necessary to replace the ignition-voltage cover before placing the device in operation. Otherwise the crystals will be destroyed! (Fig. 2).

3.4. Replacement of Crystals

Whenever the crystals are to be replaced, it should be ascertained whether the auxiliary voltage applied to the receiver blocking tube, which should come to approximately -300 volts, is being

Declassified in Part - Sanitized Copy Approved for Release 2013/01/25 : CIA-RDP80T00246A066200010001-5

Declassified in Part - Sanitized Copy Approved for Release 2013/01/25 : CIA-RDP80T00246A066200010001-5

impressed.

The intermediate-frequency and fine-tuning amplifiers each contain one pair of Type OA 513 silicon diodes.

The following points should be borne in mind when handling these crystals.

+ Crystals that have been unpacked from their metallic screening should not be placed in a room in which a high-frequency oscillator is at work.

+ All procedures involving the crystals must be carried out with the installation shut down.

+ The crystals should not be subjected to any shock or impact loads.

+ Crystals are to be exchanged only in pairs. They have already been packed in pairs in the spare-parts box.

+ In the exchange operation, the defective crystals are to be removed. This is done by manipulation of the following hand controls.

1. Unscrew screw cap (Fig. 3).

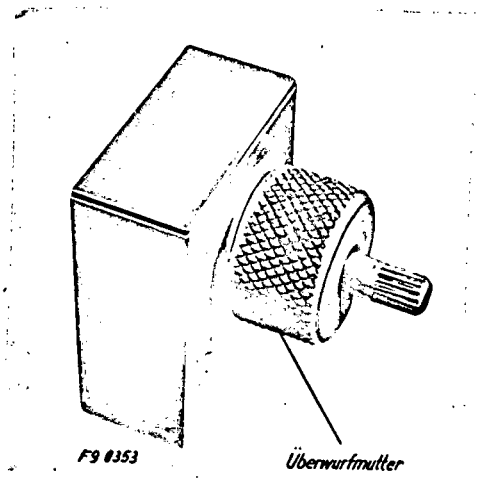


Fig. 3. 1) Screw cap.

2. Remove crystal holder (Fig. 4).

Declassified in Part - Sanitized Copy Approved for Release 2013/01/25 : CIA-RDP80T00246A066200010001-5

Declassified in Part - Sanitized Copy Approved for Release 2013/01/25 : CIA-RDP80T00246A066200010001-5

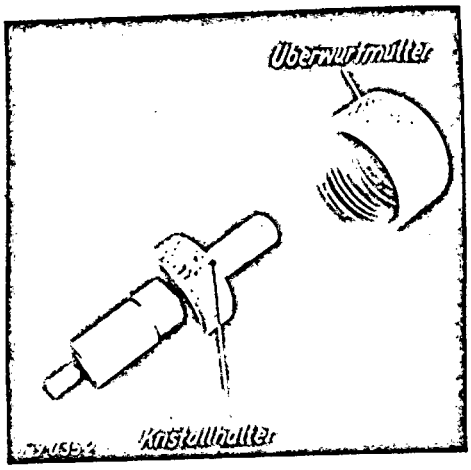


Fig. 4. 1) Screw cap; 2) crystal holder.

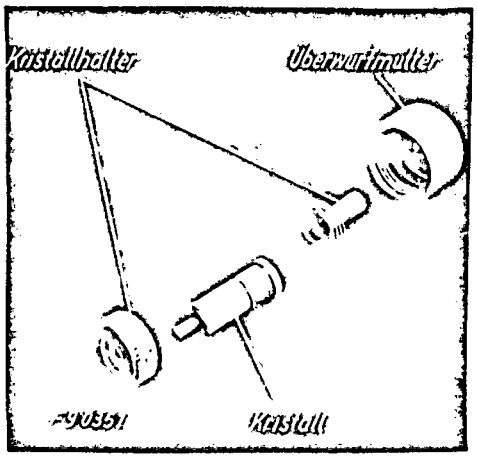


Fig. 5. 1) Crystal holder; 2) screw cap; 3) crystal.

3. The crystal is to be removed after the opening the crystal holder (Fig. 5).

4. Insert the new crystal in the crystal holder. During this process, the free hand should be placed on the housing in order to ground out divert detrimental electric charges.

5. Cautious replacement of crystal holder.

6. Screw cap is screwed on again.

+ If the crystals fail again shortly after replacement, another check should be run to determine whether the auxiliary voltage is being fed to the receiver blocking tube. If the voltage is being impressed and the crystals still fail, the receiver blocking tube is to be replaced.

+ In G 3, the top of the intermediate-frequency amplifier has two crystal holders in which a pair of spare crystals can be placed. These can be checked out in advance and then stand ready at all times for quick crystal changes.

Declassified in Part - Sanitized Copy Approved for Release 2013/01/25 : CIA-RDP80T00246A066200010001-5

Declassified in Part - Sanitized Copy Approved for Release 2013/01/25 : CIA-RDP80T00246A066200010001-5

APPENDIX

TABLE OF CONTENTS

Declassified in Part - Sanitized Copy Approved for Release 2013/01/25 : CIA-RDP80T00246A066200010001-5

Declassified in Part - Sanitized Copy Approved for Release 2013/01/25 : CIA-RDP80T00246A066200010001-5

APPENDIX

TABLE OF CONTENTS (CONTINUED)

Declassified in Part - Sanitized Copy Approved for Release 2013/01/25 : CIA-RDP80T00246A066200010001-5

Declassified in Part - Sanitized Copy Approved for Release 2013/01/25 : CIA-RDP80T00246A066200010001-5

Symbol	Name of Item	Reference No.	Electrical Values and Remarks
Gr 1	Rectifier Consists of Graetz rectifier circuit using:		
Gr 1/1 to Gr 1/4	Selenium rectifiers (four units)	A 250/100-1.2/25fs Order No. 183a	250 v AC (effective), 100 v DC with current of 1.2 amp
Ke 1 to Ke 34	Marine terminal (17 units)	A 2.2 FWB-N 506.615	
Rs 1	Air break	LF 10v Pl.-No. 394 684	380v AC, supplier: EAW-Treptow
Rs 2	Intermediate relay	RH 91 Pl.-No. 351467	220v AC without housing, supplier: EAW-Treptow
Rs 3	Intermediate relay	RH 100 Pl.-No. 361700	24v DC without housing, supplier: EAW-Treptow
Sch 1	Miniature motor overload switch	Mb 6 Pl.-No. 394397	2.5...4 amps, supplier: EAW-Treptow
Si 1	G fuse insert	E 16 Key-No. 24405.4	6 amps, supplier: IKA Sondershausen
Si 2	G fuse insert	E 16 Key-No. 24403.4	6 amps, supplier: IKA Sondershausen
Si 3	G fuse insert	E 16 Key-No. 24403.4	6 amps, supplier: IKA Sondershausen
Si 4	G fuse insert	1.6 DIN 41571	1.6 amp, 250v medium delay
Si 5	G fuse insert	1.6 DIN 41571	1.6 amp, 250v medium delay
Si 6	Toggle-type circuit breaker	Pl.-No. 286 200/ /10/EL	10 amp. Supplier: IKA Annaberg
Si 7	Toggle-type circuit breaker	Pl.-No. 286 200/ /10/EL	10 amp. Supplier: IKA Annaberg
Si 8	G fuse	E 16 Key-No. 24403.20	1 amp. Supplier: IKA Sondershausen
Si 9	G fuse	E 16 Key-No. 24403.20	1 amp. Supplier: IKA Sondershausen
Si 10	G fuse	E 16 Key-No. 24403.20	1 amp. Supplier: IKA Sondershausen

Declassified in Part - Sanitized Copy Approved for Release 2013/01/25 : CIA-RDP80T00246A066200010001-5

Declassified in Part - Sanitized Copy Approved for Release 2013/01/25 : CIA-RDP80T00246A066200010001-5

Key to Drawing No. 1420.008-00001 to 00006 Bp 2: 1) Auxiliary line unit Z 3; 2) from 380-volt AC on-board line; 3) from 220-volt alternating current on-board line; 4) Type DEUB 2-300 B/500 converter; 5) Type 56/31 carbon pressure regulator; 6) to antenna; 7) to low-voltage line unit; 8) to main display unit; 9) VEB Funkwerk Koepenick; 10) publication; 11) date 3 September 1959; 12) title: Connection Plan, 220/380 v AC for FGS 392 ship's radar installation; 13) Drawing No. 1420.008-00001 to 00006 Bp 2.

Declassified in Part - Sanitized Copy Approved for Release 2013/01/25 : CIA-RDP80T00246A066200010001-5

Declassified in Part - Sanitized Copy Approved for Release 2013/01/25 : CIA-RDP80T00246A066200010001-5

Key to Drawing No. 1420.008-00004 to 00006 Bp 1: 1) Low-voltage line unit N 3; 2) sea-clutter suppression; 3) sector; 4) to auxiliary line unit; 5) antenna; 6) low-voltage line unit; 7) main display unit; 8) all unlabeled cables are MKK; 9) antenna drive; 10) generator G 3; 11) intermediate-frequency amplifier; 12) dead-ahead; 13) main display unit H 3; 14) cable...; 15) terminal box for H 3; 16) from compass; 17) authority; 18) date: 1958;19) prepared 12 November; 20) checked; 21) rechecked; 22) VEB Funkwerk Koepenick; TP 1; 23) title: Connection Plan for FTS-392 anticollision apparatus..

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Declassified in Part - Sanitized Copy Approved for Release 2013/01/25 : CIA-RDP80T00246A066200010001-5

Key to Drawing No. 1420.008-00004 to 00006 Up 1: 1) Low-voltage line unit N 3; 2) high voltage; 3) magnetron heater; 4) U_a (sea-clutter suppression); 5) generator T 3; 6) antenna drive A 3; 7) from 380-v AC on-board line; 8) auxiliary line unit Z 3; 9) from 220-v AC on-board line; 10) converter set; 11) terminal box for H 3; 12) main display unit;H 3; 13) dead-ahead marker; 14) field regulator; 15) readiness; 16) in; 17) ranges; 18) out; 19) sea-clutter suppression; 20) VEB Funkwerk Koepenick; 21) title: Partial Diagram of FGS 392 ship's radar installation; 22) Drawing No. 1420.008--00004 to 00006 Up 1; 23) Mueller, 4 September 1959.

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Antenna Drive A 3

Polyphase Model

Symbol	Name of Item	Reference No.	Electrical Values and Remarks
Bu 1	Spring contact strip, complete, quintuple	69.11.914-00001 (4)	Design unit
Dm 1	90/115/4 angle-data unit	6911.352-10004 Bv (4)	Design unit
Ke 1	Soldered-terminal strip	B 12 FWB-N 506.605	12 poles
Mo 1	Polyphase motor with cable lead-in	FDH 022	220/380 v, 50 cycles, 0.2 kw, 0.85/0.49 amp, 2770 rpm. Supplier: VEB Elektromotorenwerk Thurm, Model B14
Sch 1	Spring set	1551.007-01020 (5)	Design part
Sch 2	Spring set	1551.007-01035 (5)	Design part

Circuit-element list No. 1551.007-00001 SL (4)

Declassified in Part - Sanitized Copy Approved for Release 2013/01/25 : CIA-RDP80T00246A066200010001-5

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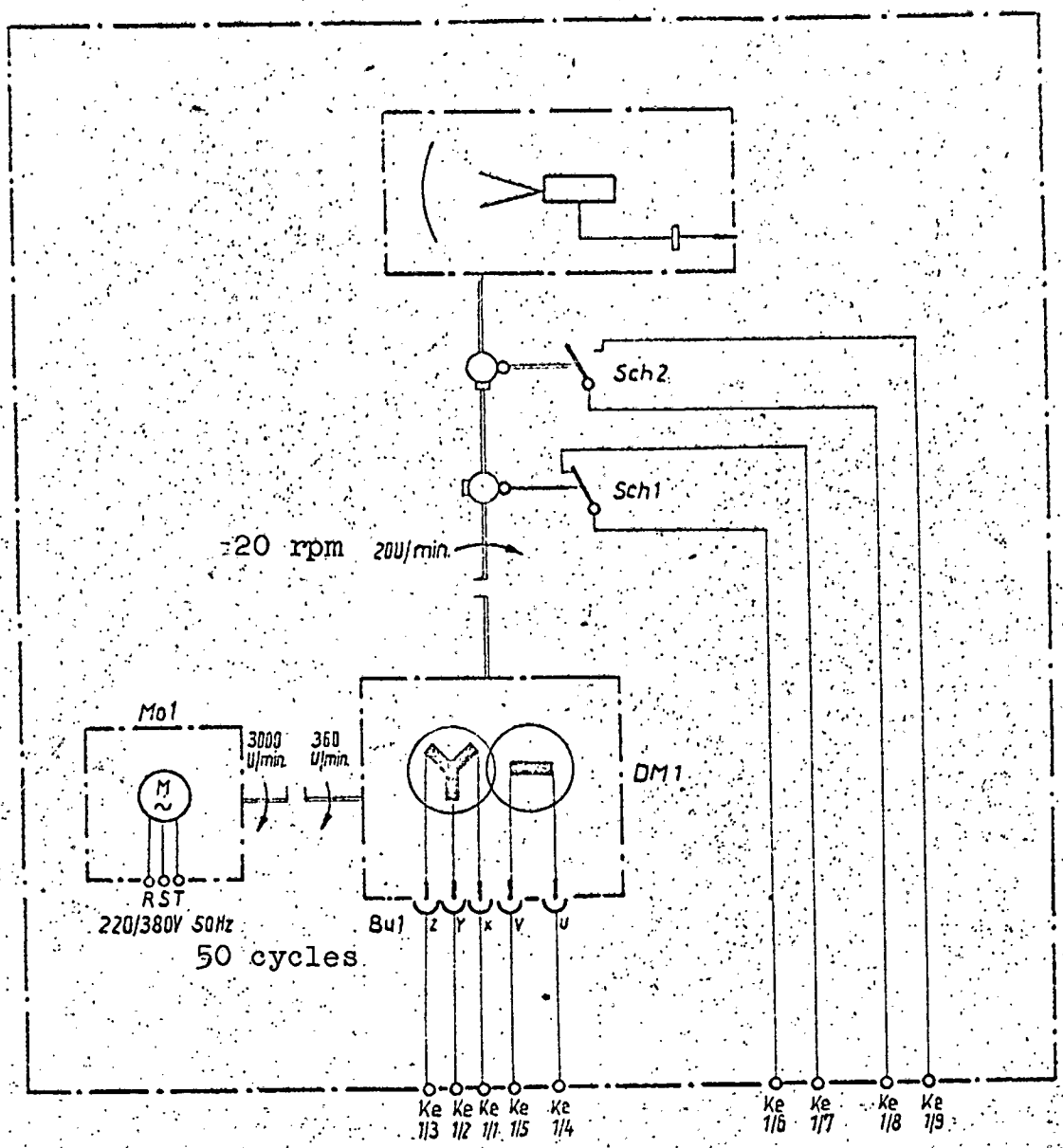

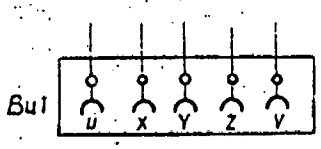

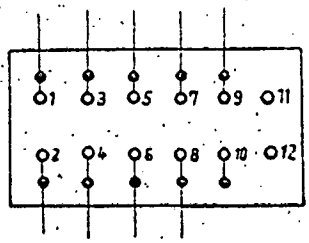

VEB Funkwerk Köpenick	Benennung Title: Antenna Drive A 3 Antennengetriebe A3	X2

Declassified in Part - Sanitized Copy Approved for Release 2013/01/25 : CIA-RDP80T00246A066200010001-5

Declassified in Part - Sanitized Copy Approved for Release 2013/01/25 : CIA-RDP80T00246A066200010001-5

Transmitter-Receiver Unit

Circuit-Element List No. 1446.002-00001 SL (4)

(Replaces...No...dated 19 December 1956)

Symbol	Name of Item	Reference No.	Electrical Values and Remarks
Bu 1	Spring contact strip	B16 DIN 41621	16 poles
Bu 2	Spring contact strip	B16 DIN 41621	16 poles
Bu 3	Spring contact strip	B8 DIN 41621	8 poles
Bu 4	Tube mount	FWB-N 509.613	
Bu 5	Spring contact strip	B8 DIN 41621	8 poles
C 1	Paper capacitor	0.25/1.6 DIN 41145	0.25 µf ±10%, rated voltage 1.6 kv DC
C 2	Paper capacitor	1446.002-02005 Bz (5)	Supplier: VEB Gera, 0.025 µf, 12/18 kv DC
C 3	Paper capacitor	1000/500 DIN 41161	1000 pf ±20%, rated voltage 500 v DC
C 4	Miniature ceramic capacitor	Rf 16000 pf 350 v DC 4 x 30 FWB-N 502.401	Epsilan
C 5	Miniature ceramic capacitor	Rf 16000 pf 350 v DC 4 x 30 FWB-N 502.401	Epsilan
C 6	Miniature ceramic capacitor	Rf 16000 pf 350 v DC 4 x 30 FWB-N 502.401	Epsilan
C 7	Miniature ceramic capacitor	Rf 16000 pf 350 v DC 4 x 30 FWB-N 502.401	Epsilan
C 8	Paper leading-in capacitor	0.025/250 DIN 41172	0.025 µf, rated voltage 250 v DC
C 9	Paper leading-in capacitor	0.025/250 DIN 41172	0.025 µf, rated voltage 250 v DC
Dr 1	Choke	0444.999-70087 Bv (5)	Design part
Dr 2	Choke	0444.999-70087 Bv (5)	Design part

Declassified in Part - Sanitized Copy Approved for Release 2013/01/25 : CIA-RDP80T00246A066200010001-5

Declassified in Part - Sanitized Copy Approved for Release 2013/01/25 : CIA-RDP80T00246A066200010001-5

Symbol	Name of Item	Reference No.	Electrical Values and Remarks
Gr 1	Selenium rectifier	B 50/40-0.6/25fs, Order No. 582 a	AC, 50v (effective); DC, 40v (average); current 0.6 amp; supplier RFT Grossraeschen
Ke 1	Soldered-terminal strip	B 10 FWB-N 506.605	10 poles; for labeling see 1446.002-01017 (4)
Ke 2	Soldered-terminal strip	B 10 FWB-N 506.605	
Ke 3	Soldered-terminal strip	1446.002-02265 (5)	Design part
KM 1	Magnet	1446.002-02062 Bz (2)	Supplier: see drawing
Ku 1	High-frequency plug connection 3/10, 70 ohms	1072.401-10001 (5)	Design part
Mo 1	Direct-current shunt motor	Type GN P 1/3.5, Key No. 7311.1	Supplier: IKA Suhl
Ro 1	Tube	SRS 454	
Ro 2	Magnetron	730	Supplier: WF-O'weide
Ro 3	Nullode	1 B 24	
Ro 4	Nullode	1 B 24	
Si 1	G fuse	4 D DIN 41571	4 amp, 250v, medium delay
Si 2	G fuse	2.5 D DIN 41571	~~2.5~~ 2.5 amp, 250v, medium delay
Si 3	G fuse	0.2 C DIN 41571	0.2 amp, 250v, medium delay
Si 4	G fuse	1 C DIN 41571	1 amp, 250v, medium delay
Si 5	Spark gap	1446.002-01018 (5)	Design part
Si 6	Spark gap	1446.002-01056 (5)	Design part
Sch 1/ /1 to Sch 1/ /3	Release contact	1446.002-01081 (4)	Design part

Declassified in Part - Sanitized Copy Approved for Release 2013/01/25 : CIA-RDP80T00246A066200010001-5

Declassified in Part - Sanitized Copy Approved for Release 2013/01/25 : CIA-RDP80T00246A066200010001-5

Symbol	Name of Item	Reference No.	Electrical Values and Remarks
Sch 1/ /4	–	–	Included in 1446.002-0.001 (1)
Sch 2	Toggle switch	812 FWB-N 504.223	
St 1	Miniature plug	0756.099-00001 (5)	Design part
St 2	Miniature plug	0756.099-00001 (5)	Design part
Tr 1	Heater transformer	0.462.999-50048 Bv (4)	Design part
Tr 2	Heater transformer	0.462.999-10102 Bv (4)	Design part
W 1	Film-type resistor	5 kilohms, 5 DIN 41404	±10%, 2 watts
W 2	~~Film~~ Layer-type resistor	5 megohms, 5 DIN 41403	±10%, 1 watt
W 3	~~Film~~ " -type resistor	20 ohms, 5 DIN 41403	±10%, 1 watt
W 4	~~Film~~ " -type resistor	20 ohms, 5 DIN 41403	±10%, 1 watt
W 5	Resistor	1446.002-01009 (4)	10 kilohms, 10 watts, supplier WBN Teltow
W 6	Film-type resistor	200 ohms, 5 DIN 41402	±10%, 0.5 watt

Declassified in Part - Sanitized Copy Approved for Release 2013/01/25 : CIA-RDP80T00246A066200010001-5

Declassified in Part - Sanitized Copy Approved for Release 2013/01/25 : CIA-RDP80T00246A066200010001-5

Driver Stage

(2 Kilovolts, 0.2 µsec)

Circuit-Element List No. 1446.002-01066 S 1 (4)

Symbol	Name of Item	Reference No.	Electrical Values and Remarks
C 1	Paper capacitor	1000/500 DIN 41161	1000 pf, ±20%, rated voltage 500 v DC
C 2	Capacitor consisting of the following, connected in series:		
C 2/1	Paper capacitor	2500/1 DIN 41161	2500 pf, ±20%, rated voltage 1 kv DC
C 2/2	Paper capacitor	2500/1 DIN 41161	2500 pf, ±20%, rated voltage 1 kv DC
C 3	Paper capacitor	0.01/700 "d" DIN 41161	0.01 µf ±20%, rated voltage 700 v DC
C 4	Paper capacitor	0.01/500 DIN 41161	0.01 µf ±20%, rated voltage 500 v DC
C 5	Paper capacitor	0.01/250 DIN 41161	0.01 µf ±20%, rated voltage 250 v DC
C 6	Paper capacitor	0.01/500 DIN 41161	0.01 µf ±20%, rated voltage 500 v DC
C 7	Paper capacitor	0.01/500 DIN 41161	0.01 µf ±20%, rated voltage 500 v DC
C 8	Paper capacitor	0.01/250 DIN 41161	0.01 µf ±20%, rated voltage 250 v DC
C 9	Paper capacitor	0.01/500 DIN 41161	0.01 µf ±20%, rated voltage 500 v DC
C 10	Paper capacitor	0.1/2 DIN 41145	0.1 µf ±10%, rated voltage 2 kv DC
C 11	Paper capacitor	0.025/1 DIN 41161	0.025 µf ±20%, rated voltage 1 kv DC
C 12	Paper capacitor	0.1/500 DIN 41161	0.1 µf ±10%, rated voltage, 500 v DC
C 13	Paper capacitor	0.1/250 DIN 41161	0.1 µf ±10%, rated voltage, 250 v DC

Declassified in Part - Sanitized Copy Approved for Release 2013/01/25 : CIA-RDP80T00246A066200010001-5

Declassified in Part - Sanitized Copy Approved for Release 2013/01/25 : CIA-RDP80T00246A066200010001-5

Symbol	Name of Item	Reference No.	Electrical Values and Remarks
C 14	Paper capacitor	0.1/250 DIN 41161	0.1 µf ±10%, rated voltage 250 v DC
C 15	Paper capacitor	0.05/700 DIN 41161	0.05 µf ±20%, rated voltage 700 v DC
Gr 1	Rectifier consisting of the following, connected in series:		
Gr 1/1 and Gr 1/2	Selenium pill rectifiers (two)	E 540/202.5-0.005 fs, Order No. 2065	AC 540 v (effective), DC 202.5 v (average), current 0.005 amp, supplier RFT Grossraeschen
Gr 2	Rectifier consisting of the following, connected in series:		
Gr 2/1 and Gr 2/2	Selenium pill rectifiers (two)	E 640/240-0.005 fs, Order No. 2070	AC 640 v (effective), DC 240 v (average), current 0.005 amp, supplier RFT Grossraeschen
Gr 3	Selenium pill rectifier	E 1000/375-0.005 fs, FWB-N.525.213	AC 1000 v (effective), DC 375 v (average, current 0.005 A
Gr 5	Selenium pill rectifier	L 240/90-0.005 fs, Order No.	AC 240 v (effective), DC...v (average), current 0.005 amp, supplier RFT Grossraeschen
Ke 1	Leading-in terminal		Integral unit with 1446.002-01066 (2)
Bu 1	Miniature jack	0.756.100-00001 (5)	Design part
Bu 2	Miniature jack	0.756.100-00001 (5)	Design part
Ro 1	Tube	ECL 81	
Ro 2	Tube	SRS 4452	Heavy duty; supplier WF-Berlin-O'wde
Ro 3	Tube	EY 81	
Rs 1	Eliminated		

Declassified in Part - Sanitized Copy Approved for Release 2013/01/25 : CIA-RDP80T00246A066200010001-5

Declassified in Part - Sanitized Copy Approved for Release 2013/01/25 : CIA-RDP80T00246A066200010001-5

Symbol	Name of Item	Reference No.	Electrical Values and Remarks
Sp 1	Transmission-time network	0448.999-90010 Bv	Design part (0.2 µsec)
Sp 2	Eliminated		
Sp 1	Knife-switch terminal	A 16 DIN 41621	16 poles
Tr 1	Pulse transformer	0454.999-40004 Bv (4)	Design part
Tr 2	Pulse transformer	0454.000-40005 Bv(4)	Design part
Tr 3	Plate transformer	0460.999-10221 Bv (4)	Design part
W 1	Layer Film-type resistor	500 kilohms, 5%, 5 DIN 41401	±5%, 0.25 watt
W 2	Film-type resistor	40 kilohms, 5%, 5 DIN 41399	±5%, 0.1 watt
W 3	Film-type resistor	500 kilohms, 5%, 5 DIN 41401	±5%, 0.25 watt
W 4	Film-type resistor	500 kilohms, 5%, 5 DIN 41401	±5%, 0.25 watt
W 5	Film-type resistor	5 kilohms, 5%, 5 DIN 41399	±10%, 0.1 watt
W 6	Film-type resistor	25 kilohms, 5 DIN, 41399	±10%, 0.1 watt
W 7	Film-type resistor	5 kilohms, 5 DIN 41399	±10%, 0.1 watt
W 8	Film-type resistor	5 kilohms, 5 DIN 41399	±10%, 0.1 watt
W 9	Film-type resistor	25 kilohms, 5 DIN 41399	±10%, 0.1 watt
W 10	Film-type resistor	1 kilohm, 5%, 5 DIN 41402	±5%, 0.5 watt
W 11	Film-type resistor	3 M ohms, DIN 41402	±5%, 0.5 watt
W 12	Film-type resistor	20 kilohms, 2 DIN, 41402	±5%, 0.5 watt
W 13	Film-type resistor	50 ohms, 5 DIN 41401	±10%, 0.25 watt

Declassified in Part - Sanitized Copy Approved for Release 2013/01/25 : CIA-RDP80T00246A066200010001-5

Declassified in Part - Sanitized Copy Approved for Release 2013/01/25 : CIA-RDP80T00246A066200010001-5

Symbol	Name of Item	Reference No.	Electrical Values and Remarks
W 14	Layer Film-type resistor	10 kilohms, 2 DIN 41403	±5%, 1 watt
W 15	Film-type resistor	1 M ohm, 2 DIN 41403	±5%, 1 watt

Declassified in Part - Sanitized Copy Approved for Release 2013/01/25 : CIA-RDP80T00246A066200010001-5

Declassified in Part - Sanitized Copy Approved for Release 2013/01/25 : CIA-RDP80T00246A066200010001-5

12-kv High-Voltage Line Unit (G 3)

Circuit-Element List No. 1446.002-01060 SL (4)

Symbol	Name of Item	Reference No.	Electrical Values and Remarks
C 1	Paper capacitor	1446.002-02005 Bz (5)	Supplier: RFT-Gera, ratings 0.025 µf and 12/18 kv DC
Gr 1	Rectifier consisting of the following in series:		
Gr 1/1 to Gr 1/12	Selenium pill rectifiers (12 units)	E 1000/375-0.01 fs, Order No. 2138	AC 1000 v (effective), DC 375 v (average), current 0.01 amp, supplier RFT Grossraeschen
Gr 2	Rectifier consisting of the following in series:		
Gr 2/1 to Gr 2/12	Selenium pill rectifiers (12 units)	E 1000/375-0.01 fs, Order No. 2138	AC 1000 v (effective), DC 375 v (average), current 0.01 amp, supplier RFT Grossraeschen
Tr 1	Plate transformer	0480.999-50019 Bv (4)	Design part
W 1	Film-type resistor	200-ohm 5 DIN 41402	±10%, 0.5 watt, exact value is being established at test station
W 2	Resistor	1446.002-01009	10 kilohms, 10 watts, Supplier, WBN Teltow
St 1	Knife-~~switch~~ Type terminal strip	A 8 DIN 41621	8 poles

Declassified in Part - Sanitized Copy Approved for Release 2013/01/25 : CIA-RDP80T00246A066200010001-5

Declassified in Part - Sanitized Copy Approved for Release 2013/01/25 : CIA-RDP80T00246A066200010001-5

Intermediate-Frequency Amplifier With Mixer Head

Circuit-Element List No. 1446.002-01019 S1 (4)

Symbol	Name of Item	Reference No.	Electrical Values and Remarks
Bu 1	Connector jack	1446.002-02083 Bz (5)	Supplier: Rafena
Bu 2	Connector jack	1446.002-02083 Bz (5)	Supplier: Rafena
C 1	Tubular trimmer	Ko 3386	0.5...5 pf, operating voltage 250 v DC/160 v AC, Supplier IKA-KWH
C 2	Tubular trimmer	Ko 3386	
C 3	Miniature capacitor	RKo 1955, 2000 pf	Epsilan, rated voltage 250 v DC, Supplier IKA-KWH
C 4	Tubular trimmer	Ko 3386	0.5...5 pf, operating voltage 250 v DC/160 v AC, Tempa S, Supplier IKA-KWH
C 5	Miniature capacitor	RKo 1955, 2000 pf	Epsilan, rated voltage 250 v DC, Supplier IKA-KWH
C 6	Miniature capacitor	RKo 1955, 2000 pf	
C 7	Miniature capacitor	RKo 1955, 2000 pf	
C 8	Miniature capacitor	RKo 1955, 2000 pf	
C 9	Dropped		
C 10	Miniature capacitor	RKo 1955, 2000 pf	Epsilan, rated voltage 250 v DC, Supplier IKA-KWH
C 11	Paper capacitor	500/700 DIN 41161	500 pf, +20%, rated voltage 700 v DC
C 12	Miniature capacitor	RKo 1955, 2000 pf	Epsilan, rated voltage 250 v DC, Supplier IKA-KWH
C 13	Miniature capacitor	RKo 1955, 2000 pf	
C 14	Miniature capacitor	RKo 1955, 2000 pf	
C 15	Miniature capacitor	RKo 1955, 2000 pf	
C 16	Paper capacitor	500/700 DIN 41161	500 pf, +20%, rated voltage 700 v DC

Declassified in Part - Sanitized Copy Approved for Release 2013/01/25 : CIA-RDP80T00246A066200010001-5

Declassified in Part - Sanitized Copy Approved for Release 2013/01/25 : CIA-RDP80T00246A066200010001-5

Symbol	Name of Item	Reference No.	Electrical Values and Remarks
C 17	Miniature capacitor	RKo 1955, 2000 pf	Epsilan, rated voltage 250 v DC
C 18	Dielectric capacitor		Included in 1446.002-01050 (2)
C 19	Miniature capacitor	RKo 1955, 2000 pf	Epsilan, rated voltage 250 v DC
C 20	Dielectric capacitor		Included in 1446.002-01050 (2)
C 21	Miniature capacitor	RKo 1955, 2000 pf	Epsilan, rated voltage 250 v DC, Supplier IKA-KWH
C 22	Miniature capacitor	RKo 1955, 2000 pf	
C 23	Miniature ceramic capacitor	Rd 10 pf 5% 500 v, 3 x 12, DIN 41371	Tempa S balancing capacitor, rated voltage 500 v DC
C 24	Miniature capacitor	RKo 1955, 2000 pf	Epsilan, rated voltage 250 v DC, supplier IKA-KWH
C 25	Miniature capacitor	RKo 1955, 2000 pf	
C 26	Miniature capacitor	RKo 1955, 2000 pf	
C 27	Miniature capacitor	RKo 1955, 2000 pf	
C 28	Miniature capacitor	RKo 1955, 2000 pf	
C 29	Tubular trimmer	Ko 3394	0.3...3 pf, operating voltage 250 v DC/160 v AC, supplier IKA-KWH
C 30	Miniature capacitor	RKo 1955, 2000 pf	Epsilan, rated voltage 250 v, DC, Supplier IKA-KWH
C 31	Miniature capacitor	RKo 1955, 2000 pf	
C 32	Miniature capacitor	RKo 1955, 2000 pf	
C 33	Miniature capacitor	RKo 1955, 2000 pf	
C 34	Miniature capacitor	RKo 1955, 2000 pf	
C 35	Miniature capacitor	RKo 1955, 2000 pf	
C 36	Miniature ceramic capacitor	Rd 10 pf 5% 500 v 3 x 12 DIN 41371	Tempa S balancing capacitor, rated voltage 500 v DC
C 37	Dropped		
C 38	Leading-in capacitor	VsKo 0036, 5000 pf	Epsilan, rated voltage 250 v DC, supplier IKA-KWH

Declassified in Part - Sanitized Copy Approved for Release 2013/01/25 : CIA-RDP80T00246A066200010001-5

Declassified in Part - Sanitized Copy Approved for Release 2013/01/25 : CIA-RDP80T00246A066200010001-5

Symbol	Name of Item	Reference No.	Electrical Values and Remarks
C 39	Miniature capacitor	RKo 1955, 2000 pf	Epsilan, rated voltage 250 v DC, supplier IKA-KWH
C 40	Miniature capacitor	RKo 1955, 2000 pf	
C 41	Miniature capacitor	RKo 1955, 2000 pf	
C 42	Leading-in capacitor	VsKo 0265, 160 pf	Condensa F, rated voltage 500 v DC
C 43	Leading-in capacitor	VsKo 0336, 5000 pf	Epsilan, rated voltage 350 v DC, Supplier IKA-KWH
C 44	Leading-in capacitor	VsKo 0336, 5000 pf	Epsilan, rated voltage 350 v DC, supplier IKA-KWH
C 45	Leading-in capacitor	VsKo 0336, 5000 pf	
C 46	Leading-in capacitor	RKo 1955, 2000 pf	Epsilan, rated voltage 250 v DC, supplier IKA-KWH
C 47	Leading-in capacitor	RKo 1955, 2000 pf	
Dr 1	High-frequency choke	0444.999-70089 Bv (5)	Design part
Dr 2	High-frequency choke	0444.999-70089 Bv (5)	Design part
Dr 3	High-frequency choke	0444.999-70089 Bv (5)	Design part
Dr 4	High-frequency choke	0444.999-70089 Bv (5)	Design part
Dr 5	High-frequency choke	0444.999-70088 Bv (5)	Design part
Dr 6	High-frequency choke	0444.999-70088 Bv (5)	Design part
Dr 7	High-frequency choke	0444.999-70088 Bv (5)	Design Part
Dr 8	High-frequency choke	0444.999-70088 Bv (5)	Design part
Dr 9	High-frequency choke	0444.999-70088 Bv (5)	Design part
Dr 10	High-frequency choke	0444.999-70088 Bv (5)	Design part
Dr 11	High-frequency choke	0444.999-70087 Bv (5)	Design part

Declassified in Part - Sanitized Copy Approved for Release 2013/01/25 : CIA-RDP80T00246A066200010001-5

Declassified in Part - Sanitized Copy Approved for Release 2013/01/25 : CIA-RDP80T00246A066200010001-5

Symbol	Name of Item	Reference No.	Electrical Values and Remarks
Dr 12	High-frequency choke	0444.999-70089 Bv (5)	Design part
Dr 13	High-frequency choke	0444.999-70087 Bv (5)	Design part
Dr 14	High-frequency choke	0444.999-70088 Bv (5)	Design part
Gr 1	Silicon diode	OA 513	Model 1, supplier WBN Teltow
Gr 2	Silicon diode	OA 513	Model 1, supplier WBN Teltow
Ro 1	Tube	ECC 84	
Ro 2	Tube	EF 80	
Ro 3	Tube	EF 80	
Ro 4	Tube	EF 80	
Ro 5	Tube	EF 80	
Ro 6	Tube	EF 80	
Ro 7	Metal klystron	723 A/B	Supplier: WF Berlin-O'weide
St 1	Knife-~~switch~~ type terminal strip	A 8 DIN 41621	8 poles
St 2	Plugs (plate connections)	-	Designed integral with Ro 7
Sp 1	High-frequency coil	0446.999-10065 Bv (5)	Design part
Sp 2	High-frequency coil	0446.999-10066 Bv (5)	Design part
Sp 3	High-frequency coil	0444.999-70088 Bv (5)	Design part
Sp 4	High-frequency coil	0444.999-10154 Bv (5)	Design part
Sp 5	High-frequency coil	0444.999-10106 Bv (5)	Design part
Sp 6	High-frequency coil	0444.999-10106 Bv (5)	Design part

Declassified in Part - Sanitized Copy Approved for Release 2013/01/25 : CIA-RDP80T00246A066200010001-5

Declassified in Part - Sanitized Copy Approved for Release 2013/01/25 : CIA-RDP80T00246A066200010001-5

Symbol	Name of Item	Reference No.	Electrical Values and Remarks
Sp 7	High-frequency coil	0444.999-10106 Bv (5)	Design part
Sp 8	High-frequency coil	0444.999-10105 Bv (5)	Design part
Sp 9	High-frequency coil	0446.999-10067 Bv (5)	Design part
W1	Layer Film-type resistor	2.5 kilohms 10% 5 DIN 41399	±10%, 0.1 watt
W2	" Film-type resistor	125 ohms, 10% 5 DIN 41399	±10%, 0.1 watt
W3	" Film-type resistor	125 ohms, 10% 5 DIN 41399	±10%, 0.1 watt
W4	" Film-type resistor	1.6 kilohms, 10% 5 DIN 41398	±10%, 0.05 watt
W 5	" Film-type resistor	500 ohms 5 DIN 41399	±10%, 0.1 watt
W 6	" Film-type resistor	30 ohms, 10%, 5 DIN 41399	±10%, 0.1 watt
W 7	Resistor consisting of the following, connected in series		1.5 kilohm
W 7/1	Layer Film-type resistor	1 kilohm, 10% 5 DIN 41398	±10%, 0.05 watt
W 7/2	" Film-type resistor	500 ohms, 10% 5 DIN 41398	±10%; 0.05 watt
W 8	" Film-type resistor	500 ohms, 5 DIN 41399	±10%, 0.1 watt
W 9	" Film-type resistor	160 ohms, 10% 5 DIN 41399	±10%, 0.1 watt
W 10	" Film-type resistor	1.6 kilohms, 10%, 5 DIN 41398	±10%, 0.05 watt
W 11	" Film-type resistor	100 ohms, 5 DIN 41401	±10% 0.25 watt
W 12	" Film-type resistor	500 ohms, 5 DIN 41399	±10% 0.1 watt
W 13	Dropped		

Declassified in Part - Sanitized Copy Approved for Release 2013/01/25 : CIA-RDP80T00246A066200010001-5

Declassified in Part - Sanitized Copy Approved for Release 2013/01/25 : CIA-RDP80T00246A066200010001-5

Symbol	Name of Item	Reference No.	Electrical Values and Remarks
W 14	Resistor layer	-	Included in 1446.002-01050 (2)
W 15	Film-type resistor	160 ohms 10% 5 DIN 41399	±10%, 0.1 watt
W 16	Film-type resistor	500 ohms, 10% 5 DIN 41399	±10%, 0.1 watt
W 17	Film-type resistor	100 ohms, 5 DIN 41401	±10%, 0.25 watt
W 18	Film-type resistor	500 ohms, 5 DIN 41399	±10%, 0.1 watt
W 19	Film-type resistor	160 ohms, 10% 5 DIN 41399	±10%, 0.1 watt
W 20	Resistor consisting of the following, connected in series:		1.5 kilohms
W20/1	Film-type resistor	1 kilohm, 10% 5 DIN 41398	±10%, 0.05 watt
W20/2	Film-type resistor	500 ohms, 10% 5 DIN 41398	±10%, 0.05 watt
W 21	Film-type resistor	500 ohms, 5 DIN 41399	±10%, 0.1 watt
W 22	Film-type resistor	160 ohms, 5 DIN 41399	±10%, 0.1 watt
W 23	Film-type resistor	500 kilohms, 10% 5 DIN 41401	±10%, 0.25 watt
W 24	Film-type resistor	500 ohms, 5 DIN 41399	±10%, 0.1 watt
W 25	Resistor consisting of the following in series connection:		3.75 kilohms
W 25/1	Film-type resistor	1.25 kilohm, 10% 5 DIN 41398	±10%, 0.05 watt
W 25/2	Film-type resistor	2.5 kilohm, 10% 5 DIN 41398	±10%, 0.05 watt
W 26	Film-type resistor	50 ohms 10% 5 DIN 41399	±10%, 0.1 watt

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Declassified in Part - Sanitized Copy Approved for Release 2013/01/25 : CIA-RDP80T00246A066200010001-5

Symbol	Name of Item	Reference No:	Electrical Values
W 27	Film-type resistor	100 kilohms, 5 DIN 41401	±10%, 0.25 watt
W 28	Film-type resistor	20 kilohms, 5 DIN 41399	±10%, 0.1 watt

Declassified in Part - Sanitized Copy Approved for Release 2013/01/25 : CIA-RDP80T00246A066200010001-5

Declassified in Part - Sanitized Copy Approved for Release 2013/01/25 : CIA-RDP80T00246A066200010001-5

Fine-Tuning Amplifier With Mixer Head

Circuit-Element List No. 1446.002-01089 SL (4)

Symbol	Name of Item	Reference No.	Electrical Values and Remarks
Bu 1	Receptacle		Included in 1446.002-01045 (3)
Bu 2	Plate cover	0740.002-00001 (4)	Design part
C 1	Capacitor	-	Included in 1446.002-01045 (3)
C 2	Capacitor	-	Included in 1446.002-01045 (3)
C 3	Tubular trimmer	Ko 3386	0.5...5 pf*, operating voltage 250 v DC/160 v AC
C 4	Tubular trimmer	Ko 3386	
C 5	Miniature capacitor	2000 pf, 250 v DC, FWB-N 502.402 KeR 351	Epsilan (Rko 2114)
C 6	Leading-in capacitor	5000/350 FWB-N 502.156	Epsilan, 500, pf, rated voltage 350 v DC
C 7	Tubular trimmer	Ko 3386	0.5...5 pf*, operating voltage 250v DC/150 v AC
C 8	Miniature capacitor	2000 pf, 250 v DC, FWB-N 502.402 KER 351	
C 9	Miniature capacitor	2000 pf, 250 v DC, FWB-N 502.402 KER 351	Epsilan (Rko 2114)
C 10	Miniature capacitor	2000 pf, 250 v DC, FWB-N 502.402 KER 351	
C 11	Disc trimmer	2/7,5 FWB-N 502.450	2...7.5 pf, Tempa S
C 12	Miniature capacitor	2000 pf, 250 v DC, FWB-N 502.402 KER 351	Epsilan (Rko 2114)
C 13	Miniature ceramic capacitor	Rd 10 pf 5% 500 v DC, 3 x 16 DIN 41370	Calit
C 14	Disc trimmer	2/7.5 FWB-N 502.450	2...7.5 pf, Tempa S

*Supplier IKA-KWH

Declassified in Part - Sanitized Copy Approved for Release 2013/01/25 : CIA-RDP80T00246A066200010001-5

Declassified in Part - Sanitized Copy Approved for Release 2013/01/25 : CIA-RDP80T00246A066200010001-5

Symbol	Name of Item	Reference No.	Electrical Values and Remarks
C 15	Miniature capacitor	20 pf, 160 v DC, FWB-N 502.402 KER 221	Calit (Rko 1932)
C 16	Miniature capacitor	40 pf, 160 v DC, FWB-N 502.402 KER 320	Tempa S (Rko 1937)
C 17	Miniature ceramic capacitor	Rd 10,000 pf, 250 v DC, 4 x 20 FWB-N 502.401	Epsilan
C 18	Miniature ceramic capacitor	Rf 25,000 pf, 500 v DC, 6 x 40 FWB-N 502.401	Epsilan
C 19	Leading-in capacitor	5000/350 FWB-N 502.156	Epsilan, 5000 pf, rated voltage 350 v DC
C 20	Leading-in capacitor	5000/350 FWB-N 502.156	Epsilan 5000 pf, rated voltage 350 v DC
C 21	Paper capacitor	0.01/250 DIN 41161	0.01 µf ±20%, rated voltage 250 v DC
C 22	Paper capacitor	0.01/250 DIN 41161	0.01 µf ±20%, rated voltage 250 v DC
C 23	Leading-in capacitor	5000/350 FWB-N 502.156	Epsilan, 500 pf, rated voltage 350 v DC
C 24	Paper capacitor	5000/125 DIN 41161	5000 pf ±20%, rated voltage 125 v DC
C 25	Paper capacitor	0.05/125 DIN 41161	0.05 µf ±20%, rated voltage 125 v DC
C 26	Leading-in capacitor	5000/350 FWB-N 502.156	Epsilan, 5000 pf, rated voltage 350 v DC
C 27	Miniature capacitor	2000 pf, 250 v DC FWB-N, 502.402 KER 351	Epsilan (RKo 2114)
C 28	MP [metallized paper] capacitor	D 1/160 DIN 41181	1 µf ±10%, rated voltage 160 v DC
C 29	dropped		

Declassified in Part - Sanitized Copy Approved for Release 2013/01/25 : CIA-RDP80T00246A066200010001-5

Declassified in Part - Sanitized Copy Approved for Release 2013/01/25 : CIA-RDP80T00246A066200010001-5

Symbol	Name of Item	Reference No.	Electrical Values and Remarks
C 30	Leading-in capacitor	5000/350 FWB-N 502.156	Epsilan, 5000 pf, rated voltage 350 v DC
C 31	Paper capacitor	0.01/250 DIN 41161	0.01 µf ±20%, rated voltage 250 v DC
C 32	MP capacitor	D 0.25/250 DIN 41181	0.25 µf ±20%, rated voltage 250 v DC
C 33	Miniature ceramic capacitor	Rd 10,000 pf, 350 v DC, 4 x 30 FWB-N 502.401	Epsilan
Dr 1	High-frequency choke	0444.999-70089 Bv (5)	Design part
Dr 2	High-frequency choke	0444.999-70089 Bv (5)	Design part
Dr 3	High-frequency choke	0444.999-79989 Bv (5)	Design part
Dr 4	High-frequency choke	0444.999-70089 Bv (5)	Design part
Dr 5	High-frequency choke	0444.999-70089 Bv (5)	Design part
Dr 6	High-frequency choke	0444.999-70087 Bv (5)	Design part
Gr 1	Silicon diode	OA 513	Model I, Supplier WBN Teltow
Gr 2	Silicon diode	OA 513	
Ro 1	Tube	EF 80	
Ro 2	Tube	EF 80	
Ro 3	Tube	EAA 91	
Ro 4	Tube	EF 80	
Ro 5	Tube	EAA 91	
Ro 6	Tube	EF 80	
Ro 7	Tube	ECC 81	
Sch 1	Dropped		
Sp 1	High-frequency coil	0446.999-10065 Bv (5)	Design part

Declassified in Part - Sanitized Copy Approved for Release 2013/01/25 : CIA-RDP80T00246A066200010001-5

Declassified in Part - Sanitized Copy Approved for Release 2013/01/25 : CIA-RDP80T00246A066200010001-5

Symbol	Name of Item	Reference No.	Electrical Values and Remarks
Sp 2	High-frequency coil	0446.999-10066 Bv (5)	Design part
Sp 3	High-frequency coil	0444.999-10106 Bv (5)	Design part
Sp 4	High-frequency coil	0446.999-10089 Bv (5)	Design part
St 1	Knife-~~switch~~ type terminal strip	A 16 DIN 41621	16 poles
W 1	~~Film~~ Layer-type resistor	2 M ohm 5 DIN 41401	±10%, 0.25 watt
W 2	~~Film~~-type resistor	50 ohms 5 DIN 41399	±10%, 0.1 watt
W 3	~~Film~~-type resistor	160 ohms 5 DIN 41399	±10%, 0.1 watt
W 4	~~Film~~-type resistor	2 kilohms 5 DIN 41399	±10%, 0.1 watt
W 5	~~Film~~-type resistor	160 ohms, 5 DIN 41399	±10%, 0.1 watt
W 6	~~Film~~-type resistor	800 ohms 5 DIN 41399	±10%, 0.1 watt
W 7	~~Film~~-type resistor	500 kilohms 2 DIN 41401	±5%, 0.25 watt
W 8	~~Film~~-type resistor	500 kilohms 2 DIN 41401	±5%, 0.25 watt
W 9	~~Film~~-type resistor	10 kilohms 5 DIN 41399	±10%, 0.1 watt
W 10	~~Film~~-type resistor	10 kilohms 5 DIN 41403	±10%, 1 watt
W 11	~~Film~~-type resistor	30 kilohms 5 DIN 41401	±10%, 0.25 watt
W 12	~~Film~~-type resistor	2 Mohms 5 DIN 41401	±10%, 0.25 watt
W 13	~~Film~~-type resistor	60 kilohms 5 DIN 41401	±10%, 0.25 watt
W 14	~~Film~~-type resistor	2 Mohms 5 DIN 41401	±10%, 0.25 watt
W 15	~~Film~~-type resistor	500 kilohms 5 DIN 41401	±10%, 0.25 watt
W 16	~~Film~~-type resistor	20 kilohms 5 DIN 41401	±10%, 0.25 watt

Declassified in Part - Sanitized Copy Approved for Release 2013/01/25 : CIA-RDP80T00246A066200010001-5

Declassified in Part - Sanitized Copy Approved for Release 2013/01/25 : CIA-RDP80T00246A066200010001-5

Symbol	Name of Item	Reference No.	Electrical Values and Remarks
W 17	dropped	-	Included in: 1446.002-01045 (3)
W 18	Layer Film-type resistor	2 Mohm 5 DIN 41401	±10%, 0.25 watt
W 19	Film-type resistor	1 Mohm 5 DIN 41401	±10%, 0.25 watt
W 20	Film-type resistor	0120.512 500k lin. 12D	500 kilohms, 0.2 watt Supplier RFT-Dorfhain
W 21	Film-type resistor	1 Mohm 5 DIN 41401	±10%, 0.25 watt
W 22	Film-type resistor	20 kilohms 5 DIN 41399	±10%, 0.1 watt
W 23	Film-type resistor	12.5 kilohms 5 DIN 41399	±10%, 0.1 watt
W 24	Film-type resistor	500 kilohms DIN 41401	±10%, 0.25 watt
W 25	Film-type resistor	20 kilohms 5 DIN 41399	±10%, 0.1 watt
W 26	Film-type resistor	0120.512 10k lin. 12D	10 kilohms, 0.2 watt Supplier RFT-Dorfhain
W 27	Film-type resistor	20 kilohms 5 DIN 41399	±10%, 0.1 watt
W 28	Film-type resistor	3 kilohms 5 DIN 41399	±10%, 0.1 watt
W 29	Film-type resistor	100 ohms 5 DIN 41399	±10%, 0.1 watt
W 30	dropped		
W 31	Film-type resistor	5 Mohm 5 DIN 41401	±10%, 0.25 watt
W 32	Film-type resistor	1.6 kilohms 5 DIN 41399	±10%, 0.1 watt
W 33	Film-type resistor	50 kilohms 5 DIN 41401	±10%, 0.25 watt
W 34	Film-type resistor	250 Kohm 5 DIN 41401	±10%, 0.25 watt
W 35	Film-type resistor	20 kilohms 5 DIN 41401	±10%, 0.25 watt

Declassified in Part - Sanitized Copy Approved for Release 2013/01/25 : CIA-RDP80T00246A066200010001-5

Declassified in Part - Sanitized Copy Approved for Release 2013/01/25 : CIA-RDP80T00246A066200010001-5

Key to Drawing No. 1446.002-00001 Sp 9: 1) 110 v/500 cycles; 2) high-voltage line unit; 3) driver stage; 4) from low-voltage line unit N 3; 5) decoupling; 6) 1B24 blocking tube; 7) transmitting frequency 9375 Mc; 8) 110 volts/500 cycles; 9) mixer head; 10) echo frequency 9375 Mc; 11) mixer head; 12) intermediate frequency = = 45 Mc; 13) intermediate-frequency amplifier; 14) fine-tuning amplifier; 15) test voltage; 16) sea-clutter suppression; 17) film-type resistors; 18) ~~and so forth~~ etc; 19) wire-wound resistors; 20) from low-voltage line unit N 3; 21) to main display unit; 22) to ~~daughter~~ slave display unit; 23) RFT Funkwerk Koepenick; 24) released 8 January 1959, Katitschke.

slave

Declassified in Part - Sanitized Copy Approved for Release 2013/01/25 : CIA-RDP80T00246A066200010001-5

Declassified in Part - Sanitized Copy Approved for Release 2013/01/25 : CIA-RDP80T00246A066200010001-5

Low-Voltage Line Unit N 3

Circuit-Components List No. 1491.052-00001 S1 (4)

Symbol	Name of Item	Reference No.	Electrical Values and Remarks
Bu 1	Spring contact strip	B 16 DIN 41 621	16 poles
Bu 2	Spring contact strip	B 8 DIN 41 621	8 poles
Bu 3	Spring contact strip	B 8 DIN 41 621	8 poles
C 1	MP-capacitor	D 4/500 DIN 41 183	4 µf ±10% rated voltage 500 v DC
C 2	MP-capacitor	D 1/500 DIN 41 183	4 µf ±10% rated voltage 500 v DC
C 3	Paper capacitor	0.025/125 DIN 41 161	0.025 µf ±20% rated voltage 125 v DC
C 4	Paper Capacitor	0.025/250 DIN 41 161	0.025 µf ±20% rated voltage 250 v DC
C 5	Paper capacitor	0.1/500 DIN 41 161	0.1 µf ±10%, rated voltage 500 v DC
C 6	MP-capacitor	D 6/350 DIN 41 183	6 µf ±10%, rated voltage 350 v DC
C 7	MP-capacitor	D 6/350 DIN 41 183	6 µf ±10%, rated voltage 350 v DC
C 8	MP-capacitor	D 4/350 DIN 41 183	4 µf ±10%, rated voltage 350 v DC
C 9	MP-capacitor	D 4/350 DIN 41 183	4 µf ±10%, rated voltage, 350 v DC
C 10	Paper capacitor	0.025/125 DIN 41 161	0.025 µf ±20%, rated voltage 125 v DC
C 11	Paper capacitor	0.025/250 DIN 41 161	0.025 µf, ±20%, rated voltage 250 v DC
C 12	Paper capacitor	0.1/250 DIN 41 161	0.1 µf ±10%, rated voltage 250 v DC
C 13	MP-capacitor	D 2/350 DIN 41 183	2 µf, ±10%, rated voltage 350 v DC
C 14	MP-capacitor	D 2/350 DIN 41 183	2 µf, ±10%, rated voltage 350 v DC

Always MP = Metal Paper

Declassified in Part - Sanitized Copy Approved for Release 2013/01/25 : CIA-RDP80T00246A066200010001-5

Declassified in Part - Sanitized Copy Approved for Release 2013/01/25 : CIA-RDP80T00246A066200010001-5

Symbol	Name of Item	Reference No.	Electrical Values and Remarks
C 15	MP-capacitor	D 1/500 DIN 41 183	1 µf ±10%, rated voltage, 500 v DC
C 16	MP-capacitor	D 2/350 DIN 41183	2 µf ±10%, rated voltage, 350 v DC
Dr 1	Choke	0456.999-10337 Bv (5)	Design part
Dr 2	Choke	0456.999-10222 Bv (5)	Design part
Gl 1	Stabilizer	StR 85/10	Supplier WF Bln-O'weid.
Gl 2	Stabilizer	StR 85/10	Supplier WF Bln-O'weid.
Gl 3	Stabilizer	StR 85/10	Supplier WF Bln-O'weid.
Gl 4	Stabilizer	StR 85/10	Supplier WF Bln-O'weid.
Gr 1	Rectifier consisting of the following in a center-tap circuit		
Gr 1/1	Selenium rectifier	E 575/230 - 0.15 fs Order No. 96a	AC 575 v (effective), DC 230 v (average), current 0.15 amps*
Gr 1/2	Selenium rectifier	E 575/230 - 0.15 fs Order No. 96a	
Gr 2	Rectifier consisting of the following in a center-tap circuit		
Gr 2/1 to Gr 2/4	Selenium rectifiers (4 units)	E 500/200 - 0.3 fs Order No. 119a	AC 500 v (effective), DC 200 v (average), current 0.3 amps*
Gr 3	Rectifier consisting of the following in a center-tap circuit		
Gr 3/1 to Gr 3/4	Selenium rectifiers (4 units)	E 400/160 - 0.15 fs Order No. 89a	AC 400 v (effective), DC 200 v (average), current 0.15 amps*

*Supplier RFT Grossraeschen.

Declassified in Part - Sanitized Copy Approved for Release 2013/01/25 : CIA-RDP80T00246A066200010001-5

Declassified in Part - Sanitized Copy Approved for Release 2013/01/25 : CIA-RDP80T00246A066200010001-5

Symbol	Name of Item	Reference No.	Electrical Values and Remarks
Gr 4	Selenium rectifier	2 x 1/2 B 450/360--0.08 fs Order No. 512a	AC 450 v (effective), DC 360 v (average), current 0.08 amps*
Gr 5	Rectifier consisting of the following in bridge circuit:		
Gr 5/1 to Gr 5/4	Germanium junction-type rectifiers (four units)	OY 111	Supplier: WBN Teltow
Gr 6	Selenium rectifier	E 300/120-0.04 fs Order No. 11a	AC 300 v (effective), DC 120 v (average), current 0.04 amp, supplier RFT Grossraeschen
Ke 1	Soldered-terminal strip	A 7 FWB-N 506.605	7 poles
Ke 2	Soldered-terminal strip	A 7 FWB-N 506.605	7 poles
Ke 3	Soldered-terminal strip	A 7 FWB-N 506.605	7 poles
Ke 4	Soldered-terminal strip	A 7 FWB-N 506.605	7 poles
Ke 5	Soldered-terminal strip	A 7 FWB-N 506.605	7 poles
Ke 6	Soldered-terminal strip	A 7 FWB-N 506.605	7 poles
Ro 1	Tube	UL 84	
Ro 2	Tube	EF 80	
Ro 3	Tube	UL 84	
Ro 4	Tube	UL 84	
Ro 5	Tube	EF 80	
Rs 1	Time relay	RZt Pl. No. 354024	20...280 sec, 110 v AC*, supplier EAW Treptow
Rs 2	Intermediate relay	RH 100 Pl. No. 361700	24 v without housing, supplier EAW Treptow*

*Impregnate to render brineproof.

Declassified in Part - Sanitized Copy Approved for Release 2013/01/25 : CIA-RDP80T00246A066200010001-5

Declassified in Part - Sanitized Copy Approved for Release 2013/01/25 : CIA-RDP80T00246A066200010001-5

Symbol	Name of Item	Reference No.	Electrical Values and Remarks
Rs 3	Intermediate relay	RH 100 Pl. No. 361700	24 v without housing, supplier EAW Treptow*
Sch 1	Switch contact	E 1	Supplier Bernstein Leipzig
Si 1	G fuse	0.035 C DIN 41 571	0.035 amp, 250 v, medium delay
Si 2	G fuse	0.1 C DIN 41 571	0.1 amp, 250 v medium delay
Si 3	G fuse	0.25 C DIN 41 571	0.25 amps 250 v medium delay
Si 4	G fuse	1.6 D DIN 41 571	1.6 amp, 250 v medium delay
Si 5	G fuse	0.05 C DIN 41 571	0.05 amp, 250 v medium delay
Si 6	G fuse	0.16 C DIN 41 571	0.16 amp, 250 v medium delay
Si 7	G fuse	0.06 C DIN 41 571	0.06 amp, 250 v medium delay
Si 8	G fuse	6 D DIN 41 571	6 amp, 250 v medium delay
Si 9	G fuse	1.6 D DIN 41 571	1.6 amp, 250 v medium delay
Si 10	G fuse	2.5 D DIN 41 571	2.5 amp, 250 v medium delay
Si 11	G fuse	4 D DIN 41 571	4 amp 250 v medium delay
St 1	~~Knife-switch~~ Terminal ~~contact~~ strip	A 16 DIN 41 621	16 poles
St 2	~~Knife-switch~~ Terminal ~~contact~~ strip	A 8 DIN 41 621	8 poles
Tr 1	Plate transformer	0460.999-50081 Bv (4)	Design part
W 1	dropped		
W 2	dropped		

Declassified in Part - Sanitized Copy Approved for Release 2013/01/25 : CIA-RDP80T00246A066200010001-5

Declassified in Part - Sanitized Copy Approved for Release 2013/01/25 : CIA-RDP80T00246A066200010001-5

Symbol	Name of Item	Reference No.	Electrical Values and Remarks
W 3	dropped		
W 4	dropped		
W 5	dropped		
W 6	dropped		
W 7	Layer Film-type resistor	1 kilohm, 5 DIN 41 403	±10% 1 watt
W 8	Film-type resistor	10 kilohms, 5 DIN 41 401	±10%, 0.25 watt
W 9	Film-type resistor	500 kilohms 5 DIN 41 401	±10%, 0.25 watt
W 10	Film-type resistor	100 kilohms 5 DIN 41 401	±10%, 0.5 watt
W 11	Film-type resistor	80 kilohms 5 DIN 41 401	±10%, 0.25 watt
W 12	Film-type resistor	125 kilohms 5 DIN 41 402	±10% 0.5 watt
W 13	Variable Film-type resistor	0 120 512 10 k lin 12 D	10 kilohms, 0.2 watt supplier RFT-Dorfhain
W 14	Film-type resistor	40 kilohms 5 DIN 41 401	±10%, 0.25 watt
W 15	Film-type resistor	10 kilohms 5 DIN 41 401	±10%, 0.25 watt
W 16	Film-type resistor	10 kilohms 5 DIN 41 401	±10%, 0.25 watt
W 17	Film-type resistor	500 kilohms 5 DIN 41 401	±10%, 0.25 watt
W 18	Film-type resistor	50 kilohms 5 DIN 41 401	±10%, 0.25 watt
W 19	Film-type resistor	25 kilohms 5 DIN 41 401	±10%, 0.25 watt
W 20	Film-type resistor	50 kilohms 5 DIN 41 401	±10%, 0.25 watt
W 21	Variable film-type resistor	0 120 512 10 k lin 12 D	10 kilohms, 0.2 watt Supplier RFT Dorfhain

Declassified in Part - Sanitized Copy Approved for Release 2013/01/25 : CIA-RDP80T00246A066200010001-5

Declassified in Part - Sanitized Copy Approved for Release 2013/01/25 : CIA-RDP80T00246A066200010001-5

Symbol	Name of Item	Reference No.	Electrical Values and Remarks
W 22	~~Film~~ Layer-type resistor	40 kilohms 5 DIN 41 401	±10%, 0.25 watt
W 23	Film-type resistor	1 kilohm 5 DIN 41 403	±10%, 1 watt
W 24	Film-type resistor	1 kilohm 5 DIN 41 403	±10%, 1 watt
W 25	Film-type resistor	6 kilohms 5 DIN 41 403	±10%, 1 watt
W 26	Film-type resistor	200 kilohms 5 DIN 41 402	±10%, 2 watt
W 27	Wire-wound resistor	500 ohms 2 DIN 41 413	±10%, 2 watt
W 28	dropped		
W 29	Film-type resistor	500 ohms 5 DIN 41404	±10%, 2 watt*
W 30	Film-type resistor	800 ohms 5 DIN 41403	±10%, 1 watt*
W 31	Film-type resistor	5 kilohms 5 DIN 41403	±10%, 1 watt

*Exact value being established at test station.

Declassified in Part - Sanitized Copy Approved for Release 2013/01/25 : CIA-RDP80T00246A066200010001-5

Declassified in Part - Sanitized Copy Approved for Release 2013/01/25 : CIA-RDP80T00246A066200010001-5

Master Oscillator

Circuit Elements List No. 1491.052-01020 SL (4)

Symbol	Name of Item	Reference No.	Electrical Values and Remarks
C 1	MP capacitor	0.5/350 DIN 41181	0.5 µf, ±20%, rated voltage, 350 v DC
C 2	Paper Capacitor	0.01/250 DIN 41161	0.01 µf, ±20%, rated voltage 250 v DC
C 3	Miniature ceramic capacitor	Rd 10 pf 10% 500 v DC 3 x 12 DIN 41371	Tempa S
C 4	Paper capacitor	1000/500 DIN 41161	1000 pf, ±20%, rated voltage, 500 v DC
C 5	Paper capacitor	1000/500 DIN 41161	1000 pf, ±20%, rated voltage, 500 v DC
C 6	Paper capacitor	0.05/500 DIN 41161	0.05 µf, ±20%, rated voltage, 500 v, DC
C 7	Paper capacitor	1000/500 DIN 41161	1000 pf, ±20%, rated voltage, 500 v DC
C 8	Paper capacitor	1000/500 DIN 41161	1000 pf, ±20%, rated voltage, 500 v DC
C 9	Paper capacitor	0.05/500 DIN 41161	0.05 µf, ±20%, rated voltage, 500 v DC
Dr 1	Choke	0446.999-10080 Bv (4)	Design part
Gr 1	Rectifier consisting of the following in bridge circuit:		
Gr 1/1 to Gr 1/4	Germanium diodes (4 units)	OA 625	Model III, Supplier WBN Teltow
Gr 2	dropped		

Declassified in Part - Sanitized Copy Approved for Release 2013/01/25 : CIA-RDP80T00246A066200010001-5

Declassified in Part - Sanitized Copy Approved for Release 2013/01/25 : CIA-RDP80T00246A066200010001-5

Symbol	Name of Item	Reference No.	Electrical Values and Remarks
Gr 3	Germanium-diode	OA 625	Model III, Supplier WBN Teltow
Ke 1	Soldered-terminal strip	1491.052-02032 (5)	Design part
LzK1	~~Transmission-time~~ Retardation network	0448.999-90018 Bv (4)	Design part
Ro 1	Tube	ECC 81	
Ro 2	Tube	ECC 81	
St 1	~~Knife-switch contact~~ Type Terminal strip	A 8 DIN 41621	8 poles
Tr 1	Input transformer	0450.999-50008 Bv (4)	Design part
Tr 2	Pulse transformer	0454.999-40004 Bv (4)	Design part
Tr 3	Pulse transformer	0454.999-40004 Bv (4)	Design part
W 1	~~Film~~ Layer-type resistor	100 K ohm 5 DIN 41401	±10%, 0.25 watt
W 2	Film-type resistor	1 M ohm 5 DIN 41401	±10%, 0.25 watt
W 3	Variable film-type resistor	0120.512 100k lin 12 D	100 K, 0.2 watt Supplier RFT-Dorfhain
W 4	Film-type resistor	200 K ohm 5 DIN 41401	±10%, 0.25 watt
W 5	Film-type resistor	500 K ohm 5 DIN 41401	±10%, 0.25 watt
W 6	Film-type resistor	20 K ohm 5 DIN 41401	±10%, 0.25 watt
W 7	Film-type resistor	400 K ohm 5 DIN 41401	±10%, 0.25 watt
W 8	Film-type resistor	20 K ohm 5 DIN 41401	±10%, 0.25 watt
W 9	Film-type resistor	100 K ohm 5 DIN 41401	±10%, 0.25 watt
W 10	Variable film-type resistor	0120.512 10k lin 12 D	10 K, 0.2 watt
W 11	Film-type resistor	200 K ohm 2% 2 DIN 41401	±2%, 0.25 watt
W 12	Film-type resistor	10 K ohm 2% 2 DIN 41399	±2%, 0.1 watt
W 13	Film-type resistor	10 K ohm 5 DIN 41399	±10%, 0.1 watt

Declassified in Part - Sanitized Copy Approved for Release 2013/01/25 : CIA-RDP80T00246A066200010001-5

Declassified in Part - Sanitized Copy Approved for Release 2013/01/25 : CIA-RDP80T00246A066200010001-5

Symbol	Name of Item	Reference No.	Electrical Values and Remarks
W 14	Layer Film-type resistor	5 K ohm 5 DIN 41399	±10%, 0.1 watt
W 15	Film-type resistor	600 ohms 5 DIN 41399	±10%, 0.1 watt
W 16	Film-type resistor	600 ohms 5 DIN 41399	±10%, 0.1 watt
W 17	Film-type resistor	5 K ohm 5 DIN 41399	±10%, 0.1 watt
W 18	Film-type resistor	500 ohms 5 DIN 41399	±10%, 0.1 watt
W 19	Film-type resistor	10 K ohm 5 DIN 41399	±10%, 0.1 watt
W 20	Film-type resistor	500 K ohm 2% 2 DIN 41401	±2%, 0.25 watt
W 21	Film-type resistor	60 K ohm 2% 2 DIN 41401	±2%, 0.25 watt
W 22	Film-type resistor	600 ohms 5 DIN 41399	±10%, 0.1 watt

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Declassified in Part - Sanitized Copy Approved for Release 2013/01/25 : CIA-RDP80T00246A066200010001-5

Key to Drawing No. 1491.052-00001 Sp 9: 1) ~~Film~~-type resistors; 2) wire-wound resistors; 3) and so forth; 4) to oscillator G 3; 5) to main display unit H 3; 6) to daughter display unit T 3; 7) from distributor box V 3; 8) or from auxiliary line unit Z 3; 9) to main display unit H 3; 10) master oscillator G 3; 11) to daughter display unit; 12) to oscillator G 3; 13) RFT Funkwerk Koepenick; 14) low-voltage line unit N 3; 15) released 3 February 1959, Katitschke.

Main Display Unit H 3

Circuit Elements List No. 1421.002-00001 SL (4)

Symbol	Name of Item	Reference No.	Electrical Values and Remarks
Bu 1	Spring-contact strip	A 8 DIN 41621	8 poles
Bu 2	Spring-contact strip, complete, 5 units	6911.914-00001 (4)	Design part
Bu 3	Spring-contact strip, complete, 5 units	6911.914-00001 (4)	Design Part
Bu 4	High-frequency connecting-piece bushing	VB 058 A	Supplier: VEB RAFENA
C 1	MP capacitor	B 1/500 DIN 41183	1 µf ±10%, rated voltage 500 v DC
C 2	MP capacitor	B 2/350 DIN 41183	2 µf ±10%, rated voltage 500 v DC
C 3	Dropped		
C 4	Miniature ceramic capacitor	Rf 50 µµf 10% 500 v DC 4x20	Tempa S
C 5	Paper capacitor	1000/500 DIN 41161	1000 µµf ±20% rated voltage 500 v DC
C 6	Paper capacitor	0.01/250 DIN 41161	0.01 µf ±20% rated voltage 250 v DC
C 7	Miniature ceramic capacitor	Rf 250 µµf 500 v DC 4 x 20 DIN 41376	Condensa F
C 8	Miniature ceramic capacitor	Sb 10 µµf/10% DIN 41376	Condensa F, rated voltage 500 v DC
C 9	Miniature ceramic capacitor	Rf 320 µµf 10% 500 v DC 4x20 DIN 41376	Condensa F trim value
C10	Paper capacitor	0.01/250 DIN 41161	0.01 µf ±20% rated voltage 250 v DC

Declassified in Part - Sanitized Copy Approved for Release 2013/01/25 : CIA-RDP80T00246A066200010001-5

Declassified in Part - Sanitized Copy Approved for Release 2013/01/25 : CIA-RDP80T00246A066200010001-5

Symbol	Name of Item	Reference No.	Electrical Values and Remarks
C11	Miniature ceramic capacitor	Rf 50 µµf 10% 500 v DC 4x20 DIN 41371	Tempa S
C12	Paper capacitor	0.1/125 DIN 41161	0.1 2f ±10% rated voltage 125 v DC
C13	Miniature ceramic capacitor	Sb 10 µµf/10% DIN 41376	Condensa F rated voltage 500 v DC
C14	Disc capacitor	6/26 FWB-N 502.450	6...26 µµf Tempa S
C15	Miniature ceramic capacitor	Rd 160 µµf 10%, 500 v DC 4x30 DIN 41373	Tempa X
C16	Paper capacitor	0.1/125 DIN 41161	0.1 µf ±10% rated voltage 125 v DC
C17	Dropped		
C18	Paper capacitor	1000/500 DIN 41161	1000 µµf ±20% rated voltage 500 v DC
C19	Paper capacitor	1000/500 DIN 41161	1000 µµf ±20% rated voltage 500 v DC
C20	Miniature ceramic capacitor	Rf 200 µµf 10% 500 v DC 4x30 DIN 41374	Condensa N
C21	Miniature ceramic capacitor	Rf 100 µµf 10% 500 v DC 4x16 DIN 41374	Condensa N
C22	Paper capacitor	1000/500 DIN 41161	1000 µµf ±20% rated voltage 500 v DC
C23	Paper capacitor	0.01/250 DIN 41161	0.01 µf ±20% rated voltage 250 v DC
C24	Paper capacitor	5000/250 DIN 41161	5000 µµf ±20% rated voltage 250 v DC
C25	Paper capacitor	0.01/250 DIN 41161	0.01 µf ±20% rated voltage 250 v DC
C26	Paper capacitor	0.1/125 DIN 41161	0.1 2f ±20% rated voltage 125 v DC
C27	Paper capacitor	0.1/125 DIN 41161	0.1 µf ±10% rated voltage 125 v DC
C28	Paper capacitor	0.01/250 DIN 41161	0.01 µf ±20% rated voltage 250 v DC

Declassified in Part - Sanitized Copy Approved for Release 2013/01/25 : CIA-RDP80T00246A066200010001-5

Declassified in Part - Sanitized Copy Approved for Release 2013/01/25 : CIA-RDP80T00246A066200010001-5

Symbol	Name of Item	Reference No.	Electrical Values and Remarks
C29	Paper capacitor	0.1/125 DIN 41161	0,1 µf ±10% rated voltage 125 v DC
C30	Miniature ceramic capacitor	Rf 160 µµf 2% 500 v DC 4x30 DIN 41373	Tempa X
C31	Miniature ceramic capacitor	Rf 320 µµf 2% 500 v DC 4x20 DIN 41376	Condensa F
C32	Miniature ceramic capacitor	Rf 600 µµf 2% 500 v DC 4x40 DIN 41376	Condensa F*
C33	Kf [sic] capacitor	1250/2/250 DIN 41384	1250 µf ±2% rated voltage 250 v DC*
C34	Kf [sic] capacitor	2500/2/250 DIN 41384	2500 µµf ±2% rated voltage 250 v DC*
C35	Kf [sic] capacitor	5000/2/160 DIN 41384	5000 µµf ±2% rated voltage 160 v DC*
C36	Paper capacitor	0.01/250 DIN 41161	0.01 µf ±20% rated voltage 250 v DC
C37	Miniature capacitor	2000 µµf 250 v DC FWB-N 502.402 KER 351	Epsilan (RKo 2114)
C38	Miniature capacitor	2000 µµf 250 v DC FWB-N 502.402 KER 351	Epsilan (RKo 2114)
C39	Miniature capacitor	2000 µµf 250 v DC FWB-N 502.402 KER 351	Epsilan (RKo 2114)
C40	Miniature capacitor	2000 µµf 250 v DC FWB-N 502.402 KER 351	Epsilan (RKo 2114)
C41	Miniature capacitor	2000 µµf 250 v DC FWB-N 502.402 KER 351	Epsilan (RKo 2114)
C42	Miniature capacitor	2000 µµf 250 v DC FWB-N 502.402 KER 351	Epsilan (RKo 2114)

*trim value

Declassified in Part - Sanitized Copy Approved for Release 2013/01/25 : CIA-RDP80T00246A066200010001-5

Declassified in Part - Sanitized Copy Approved for Release 2013/01/25 : CIA-RDP80T00246A066200010001-5

Symbol	Name of Item	Reference No.	Electrical Values and Remarks
C 43	Miniature capacitor	2000 µµf 250 v DC FWB-N 502.402 KER 351	Epsilan (RKo 2114)
C44	Miniature capacitor	2000 µµf 250 v DC FWB-N 502.402 KER 351	Epsilan (RKo 2114)
C45	Disc trimmer	1.2/2.5 FWB-N 502.450	1.2...2.5 µµf Calit
C46	Dropped		
C47	Paper capacitor	0.01/250 DIN 41161	0.01 µf ±20% rated voltage 250 v DC
C48	Miniature ceramic capacitor	Sb 50 µµf/10% DIN 41376	Condensa F rated voltage 500 v DC
C49	Paper capacitor	0.01/250 DIN 41161	0.01 µf ±20% rated voltage 250 v DC
C50	Paper capacitor	0.01/250 DIN 41161	0.01 µf ±20% rated voltage 250 v DC
C51	MP capacitor	D 4/160 DIN 41181	4 µf ±10% rated voltage 160 v DC
C52	Paper capacitor	0.01/250 DIN 41161	0.01 µf ±20% rated voltage 250 v DC
C53	Paper capacitor	0.01/250 DIN 41161	0.01 µf ±20% rated voltage 250 v DC
C54	Paper Capacitor	0.01/500 DIN 41161	0.01 µf ±20% rated voltage 500 v DC
C55	Miniature ceramic capacitor	Rf 250 µµf 10% 500 v DC 4x20 DIN 41376	Condensa F
C56	Miniature capacitor	2000 µµf 250 v DC FWB-N 502.402 KER 351	Epsilan (RKo 2114)
C57	Paper capacitor	0.1/125 DIN 41161	0.1 µf ±10% rated voltage 125 v DC
C58	MP capacitor	D 0.25/500 DIN 41161	0.25 µf ±20% rated voltage 500 v DC
C59	Paper capacitor	0.01/500 DIN 41161	0.01 µµf ±20% rated voltage 500 v DC
C60	Paper capacitor	1000/500 DIN 41161	1000 µµf ±20% rated voltage 500 v DC

Declassified in Part - Sanitized Copy Approved for Release 2013/01/25 : CIA-RDP80T00246A066200010001-5

Declassified in Part - Sanitized Copy Approved for Release 2013/01/25 : CIA-RDP80T00246A066200010001-5

Symbol	Name of Item	Reference No.	Electrical Values and Remarks
C61	Paper capacitor	0.05/250 DIN 41161	0.05 µf +20% rated voltage 250 v DC trim value
C62	MP capacitor	D 2x0, 1/500 FWB-N 502.217	2x0,1 µf +20% rated voltage 500 v DC
C63	Paper capacitor	0.01/250 DIN 41161	0.01 µf +20% rated voltage 250 v DC
C64	Miniature ceramic capacitor	Sb 10µµf/10% DIN 41376	Condensa F rated voltage 500 v DC
C65	Paper capacitor	0.01/250 DIN 41161	0.01 µf +20% rated voltage 250 v DC
C66	Paper capacitor	1000/500 DIN 41161	1000 µµf +20% rated voltage 500 v DC
C67	Dropped		
C68	Miniature ceramic capacitor	Sb 10 µµf/10% DIN 41376	Condensa F rated voltage 500 v DC
C69	Paper capacitor	0.01/250 DIN 41161	0.01 µf +20% rated voltage 250 v DC
C70	Paper capacitor	0.01/250 DIN 41161	0.01 µf +20% rated voltage 250 v DC
C71	Capacitor consisting of the following in parallel:		0.02 µf
C71/1 to C71/2	Paper capacitors (two)	0.01/250 DIN 41161	0.01 µf +20% rated voltage 250 v DC
C72	Paper capacitor	0.025/250 DIN 41161	0.025 µf +20% rated voltage 250 v DC
C73	Miniature ceramic capacitor	Rf 250 µµf 10% 500 v DC 4x20 DIN 41376	Condensa F
C74	Paper capacitor	0.01/250 DIN 41161	0.01 µf +20% rated voltage 250 v DC
C75	Paper capacitor	0.01/500 DIN 41161	0.01 2f +20% rated voltage 500 v DC
C76	Miniature ceramic capacitor	Rf 500 µµf 10% 500 v DC 4x30 DIN 41376	Condensa F

Declassified in Part - Sanitized Copy Approved for Release 2013/01/25 : CIA-RDP80T00246A066200010001-5

Declassified in Part - Sanitized Copy Approved for Release 2013/01/25 : CIA-RDP80T00246A066200010001-5

Symbol	Name of Item	Reference No.	Electrical Values and Remarks
C77	Miniature ceramic capacitor	Sb 16 µµf/10% DIN 41376	Condensa F rated voltage 500 v DC
C78	Paper capacitor	0.01/250 DIN 41161	0.01 µf ±20% rated voltage 250 v DC
C79	Paper capacitor	0.01/250 DIN 41161	0.01 µf ±20% rated voltage 250 v DC
C80	Dropped		
C81	Miniature ceramic capacitor	Rf 100 µµf 500 v DC 4x16 DIN 41374	Condensa N
C82	Miniature ceramic capacitor	Rf 200 µµf 10% 500 v DC 4x30 DIN 41374	Condensa N
C83	Paper capacitor	0.1/250 DIN 41161	0.1 µf ±10% rated voltage 250 v DC
Dm1	Angle-data unit 70/80/6	6911.403-10001 Bv (4)	Design part
Dm2	Angle-data unit 70/80/26	6911.154-10002 Bv (4)	Design part
Gr1	Germanium diode	OA 645	Model III, supplier WBN-Teltow
Gr2	Germanium diode	OA 705	
Gr3	Germanium diode	OA705	
Gr4	Germanium diode	OA625	Model III, supplier WBN-Teltow
Gr5	Germanium diode	OA705	
Gr6	Germanium diode	OA625	
Gl 1	Stabilizer	StR 85/10	Supplier: WF-Berlin-O'weide
Ke1	Connection plate	1421.002-02487 (4)	Design part
Ke2	Connection plate	1421.002-02485 (4)	Design part
Ke3	Connection plate	1421.002-02488 (4)	Design part
Ke4	Connection plate	1421.002-02486 (4)	Design part
Ke5	Connection plate	1421.002-02563 (5)	Design part
Ke6	Connection plate	1421.002-02564 (5)	Design part

Declassified in Part - Sanitized Copy Approved for Release 2013/01/25 : CIA-RDP80T00246A066200010001-5

Declassified in Part - Sanitized Copy Approved for Release 2013/01/25 : CIA-RDP80T00246A066200010001-5

Terminal Box for H 3 Display Unit

Circuit Elements List No. 1420.001-01401 SL (5)

Symbol	Name of Item	Reference No.	Electrical Values and Remarks
Kel to Ke34	Marine terminal (17 units)	A 2.2 FWB-N 506.615	
Si1	G-fuse	E 16, Reference No. 24402.11	1.25 amp (super long delay), IKA-Sondershausen
Si2	G-fuse	0.6 C/250 DIN 41571	rated current 0.6 amp, rated voltage 250 v DC

Declassified in Part - Sanitized Copy Approved for Release 2013/01/25 : CIA-RDP80T00246A066200010001-5

Declassified in Part - Sanitized Copy Approved for Release 2013/01/25 : CIA-RDP80T00246A066200010001-5

Symbol	Name of Item	Reference No.	Electrical Values and Remarks
Ke 7	Connection plate	1421.002-02493 (5)	Design part
La1 to La6	Signal lamps (6 units)	24 v, 3 w, clear, FWB-N 521.430	
Ro1	Tube	ECC 81	
Ro2	Tube	EF 80	
Ro 3	Tube	EF 80	
Ro 4	Tube	ECC 82	
Ro 5	Tube	ECC 81	
Ro 6	Tube	EF 80	
Ro 7	Tube	EAA 91	
Ro 8	Tube	ECC 81	
Ro 9	Tube	EF 80	
Ro 10	Tube	ECC 81	
Ro 11	Tube	EL 81	
Ro 12	Tube	EF 80	
Ro 13	Tube	EF 80	
Ro 14	Tube	EF 80	
Ro 15	Tube	EL 83	
Ro 16	Tube	ECC 82	
Ro 17	Tube	EL 84	
Ro 18	Tube	EC 92	
Ro 19	Tube	EF 80	
Ro 20	Tube	ECC 81	
Ro 21	Tube	EF 80	
Ro 22	Tube	B 23 M 2 DN	After glow, aluminum backing
Rs 1	Medium round relay [sic]	TK 9-1609 Ab 4722:30-385	3R. +3 Arb. Kont. [~~abbreviations not translated~~] ~~FMW~~ Fernmelde Werk Leipzig impregnate brineproof

Declassified in Part - Sanitized Copy Approved for Release 2013/01/25 : CIA-RDP80T00246A066200010001-5

Declassified in Part - Sanitized Copy Approved for Release 2013/01/25 : CIA-RDP80T00246A066200010001-5

Symbol	Name of Item	Reference Number	Electrical Values and Remarks
Rs 2	Intermediate relay RH 100	Pl. -No.361 701	110 v DC, supplier VEB Teltow, impregnate brineproof
Rs 3	High-frequency relay	1076.013-00002 (4)	Design part, impregnate brineproof
St 1	High-frequency angled cable jack	KST 067 A	Supplier: VEB RAFENA
Sp 1	Coil	0444.999-10082 Bv (4)	Design part
Sp 2	Coil	0444.999-10105 Bv (4)	Design part
Sp 3	Coil	0446.999-10068 Bv (4)	Design part
Sp 4	Coil	0444.999-10083 Bv (4)	Design part
Sp 5	Coil	0444.999-10084 Bv (4)	Design part
Sp 6	Coil	0446.999-90019 Bv (4)	Design part
Sp 7	Coil	0488.999-90024 Bv (4)	Design part
Sp 8	Coil	0488.999-70001 Bv (4)	Design part
Sp 9	Coil	0488.999-70001 Bv (4)	Design part
Sp 10	Coil	0488.999-70001 Bv (4)	Design part
Sp 11	Coil	0488.999-70001 Bv (4)	Design part
Sch 1	Contact pile	1421.002-01212 (4)	Design part
Sch 2	Toggle switch	811 FWB-N 504.223	
Sch 3	Toggle switch	811 K	Supplier: RFT Dorfhain
Sch 4	Selector switch panel	1421.002-02500 Bz (5)	Supplier: see drawing

Declassified in Part - Sanitized Copy Approved for Release 2013/01/25 : CIA-RDP80T00246A066200010001-5

Declassified in Part - Sanitized Copy Approved for Release 2013/01/25 : CIA-RDP80T00246A066200010001-5

Symbol	Name of Item	Reference Number	Electrical Values and Remarks
Sch 5	Switch, complete	1421.002-02502 Bz (5)	Supplier: see drawing
Sch 6	Toggle switch	811 K	Supplier: RFT Dorfhain
Sch 7	Toggle switch	813 K	Supplier: RFT Dorfhain
Sch 8	Selector switch panel	1421.002-02501 Bz (5)	Supplier: see drawing
Sch 9	Selector switch panel	1421.002-02501 Bz (5)	Supplier: see drawing
Sch10	Rotary-toggle switch	1421.002-01223 (5)	Design part
Sch11	Rotary-toggle switch	1421.002-01223 (5)	Design part
Sch12	Selector switch panel	1421.002-02500 Bz (5)	Supplier: see drawing
Sch13	Cam drive	1421.002-01076 (5)	Design part
Sch14	Dropped		
Sch15	Spring-contact set	1421.002-01066 (4)	Design part
Sch16	Keyboard	List No. 5060 Special	With protective cap
Sch17	Keyboard	List No. 5060 Special	Supplier: Dux, Leipzig
Sch18	Toggle switch	814 FWB-N 504.223	
Sch19	Toggle switch	811 FWB-N 504.223	
Sch20	Spring set, complete	1421.002-01196 (5)	Design part
Tr 1	Transformer	0454.999-40004 Bv (4)	Design part
Tr 2	Transformer	0454.999-40004 Bv (4)	Design part
Tr 3	Transformer	0462.999-10079 Bv (4)	Design part
Tr 4	Transformer	0454.999-40006 Bv (4)	Design part

Declassified in Part - Sanitized Copy Approved for Release 2013/01/25 : CIA-RDP80T00246A066200010001-5

Declassified in Part - Sanitized Copy Approved for Release 2013/01/25 : CIA-RDP80T00246A066200010001-5

Symbol	Name of Item	Reference Number	Electrical Values and Remarks
W 1	Film-type resistor	20 K 5 DIN 41402	±10% 0.5 w trim value
W 2	Film-type resistor	20 K 5 DIN 41402	±10% 0.5 w trim value
W 3	Film-type resistor	40 K 5 DIN 41403	±10% 1 w
W 4	Tandem rotary film-type resistor	0120 580 10k lin. 10 k lin. 50A	0.4 w Supplier: RFT-Dorfhain
W 5	Film-type resistor	40 K 5 DIN 41403	±10% 1 w
W 6	Tandem rotary film-type resistor	0120 580 10 k lin. 10 k lin. 50A	0.4 w Supplier: RFT-Dorfhain
W 7	Film-type resistor	1 M 5 DIN 41401	±10% 0.25 w
W 8	Rotary film-type resistor	0120512 500 k lin. 50A	0.2 w Supplier: RFT-Dorfhain
W 9	Rotary film-type resistor	0120512 10k neg/Log. 50A	0.1 w Supplier: RFT-Dorfhain
W10	Film-type resistor	6 K 5 DIN 41402	±10% 0.5 w
W11	Wire-wound potentiometer	25 K B 5 DD 25/A	2.5 w**
W12	Film-type resistor	60 K 5 DIN 41401	±10% 0.25 w
W13	Rotary film-type resistor	0120.512 50 k lin. 50A	50 K 0.2 w, Supplier: RFT-Dorfhain
W14	Film-type resistor	25 K 5 DIN 41399	±10% 0.1 w
W15	Film-type resistor	6 K 5 DIN 41401	±10% 0.25 w
W16	Wire-wound calibrating potentiometer	50 K B* MD 40/A	Linearity 0.5% 4w**
W17	Film-type resistor	8 K 5 DIN 41401	±10% 0.25 w
W18	Wire-wound potentiometer	500 ohms C 5 DD 35/A	3.5 w**
W19	Dropped		
W20	Film-type resistor	1 K 5 DIN 41403	±10% 1 w

*Special model, axial length 20 mm, p = 8 mm.
**Supplier: VEB Gornsdorf.

Declassified in Part - Sanitized Copy Approved for Release 2013/01/25 : CIA-RDP80T00246A066200010001-5

Declassified in Part - Sanitized Copy Approved for Release 2013/01/25 : CIA-RDP80T00246A066200010001-5

Symbol	Name of Item	Reference Number	Electrical Values and Remarks
W21	Wire-wound resistor	2 K ohm 2 DIN 41418	±10% 12 w
W22	Wire-wound resistor	2 K ohm 2 DIN 41418	±10% 4 w
W23	Wire-wound resistor	2 K ohm 2 DIN 41418	±10% 12 w
W24	Film-type resistor	50 ohms 5 DIN 41401	±10% 0.25 w
W25	Film-type resistor	10 K ohm 5 DIN 41403	±10% 1 w
W26	Film-type resistor	25 K ohm 5 DIN 41402	±10% 0.5 w
W27	Film-type resistor	100 ohms 5 DIN 41399	±10% 0.1 w
W28	Film-type resistor	100 ohms 5 DIN 41399	±10% 0.1 w
W29	Film-type resistor	10 K ohm 5 DIN 41401	±10% 0.25 w
W30	Film-type resistor	80 K ohm 5 DIN 41401	±10% 0.25 w
W31	Rotary film-type resistor	0120.512 500 k lin 50A	500 K 0.2 w Supplier: RFT-Dorfhain
W32	Film-type resistor	25 K ohm 5 DIN 41401	±10% 0.25 w
W33	Dropped		
W34	Dropped		
W35	Dropped		
W36	Wire-wound resistor	6 K ohm 2 DIN 41415	±10% 4 w
W37	Film-type resistor	12.5 K ohm 5 DIN 41404	±10% 2 w
W38	Dropped		
W39	Dropped		
W40	Dropped		
W41	Dropped		
W42	Dropped		
W43	Film-type resistor	10 K ohm 5 DIN 41398	±20% 0.05 w

Declassified in Part - Sanitized Copy Approved for Release 2013/01/25 : CIA-RDP80T00246A066200010001-5

Declassified in Part - Sanitized Copy Approved for Release 2013/01/25 : CIA-RDP80T00246A066200010001-5

Symbol	Name of Item	Reference Number	Electrical Values and Remarks
W44	Layer Film-type resistor	100 K ohm 5 DIN 41401	±20% 0.25 w
W45	Film-type resistor	5 K ohm 5 DIN 41399	±10% 0.1 w
W46	Film-type resistor	100 K ohm 5 DIN 41401	±20% 0.25 w
W47	Film-type resistor	40 K ohm 5 DIN 41398	±10% 0.05 w
W48	Film-type resistor	500 K ohm 5 DIN 41401	±20% 0.25 w
W49	Film-type resistor	300 ohms 5 DIN 41399	±10% 0.1 w
W50	Film-type resistor	300 Ohms 5 DIN 41399	±10% 0.1 w
W51	Film-type resistor	5 K ohm 5 DIN 41402	±10% 0.5 w
W52	Film-type resistor	16 K ohm 5 DIN 41402	±10% 0.5 w
W53	Film-type resistor	200 K ohm 2% 2 DIN 41401	±2% 0.25 w
W54	Film-type resistor	500 K ohm 5 DIN 41401	±2% 0.25 w
W55	Film-type resistor	300 K ohm 2% 2 DIN 41401	±2% 0.25 w
W56	Film-type resistor	60 K 2% 2 DIN 41399	±2% 0.1 w trim value
W57	Film-type resistor	25 K ohm 5 DIN 41402	±10% 0.5 w
W58	Wire-wound resistor	8 K ohm 2 DIN 41413	±10% 2 w
W59	Film-type resistor	40 K ohm 5 DIN 41599	±10% 0.1 w
W60	Film-type resistor	500 K ohm 5 DIN 41401	±20% 0.25 w
W61	Film-type resistor	2 K ohm 5 DIN 41401	±10% 0.25 w
W62	Film-type resistor	10 K ohm 5 DIN 41403	±10% 1 w
W63	Film-type resistor	1 M ohm 5 DIN 41401	±10% 0.25 w
W64	Film-type resistor	200 K ohm 5 DIN 41401	±20% 0.25 w
W65	Film-type resistor	40 K ohm 5 DIN 41398	±20% 0.05 w
W66	Wire-wound resistor	5 K ohm 2 DIN 41412	±10% 1 w
W67	Film-type resistor	200 K ohm 5 DIN 41401	±10% 0.25 w

Declassified in Part - Sanitized Copy Approved for Release 2013/01/25 : CIA-RDP80T00246A066200010001-5

Declassified in Part - Sanitized Copy Approved for Release 2013/01/25 : CIA-RDP80T00246A066200010001-5

Symbol	Name of Item	Reference Number	Electrical Values and Remarks
W68	Layer Film-type resistor	400 K ohm 5 DIN 41401	±10% 0.25 w
W69	Rotary film-type resistor	0120.512 50 k lin 12 D	50 K 0.2 w*
W70	Film-type resistor	60 K ohm 5 DIN 41398	±20% 0.05 w
W71	Film-type resistor	160 K ohm 5 DIN 41401	±20% 0.25 w
W72	Film-type resistor	2 M ohm 1% 2 DIN 41402	±1% 0.5 w
W73	Film-type resistor	20 K ohm 5 DIN 41401	±10% 0.25 w
W74	Film-type resistor	30 K ohm 5 DIN 41399	±10% 0.1 w
W75	Rotary film-type resistor	0120.512 50 k lin 12 D	50 K 0.2 w*
W76	Film-type resistor	300 K ohm 5 DIN 41401	±10% 0.25 w
W77	Film-type resistor	2 M ohm 5 DIN 41401	±10% 0.25 w
W78	Film-type resistor	20 K ohm 5 DIN 41403	±10% 1 w
W79	Film-type resistor	200 ohms 5 DIN 41401	±10% 0.25 w
W 80	Film-type resistor	2 K ohm 5 DIN 41402	±10% 0.5 w
W81	Film-type resistor	100 K ohm 5 DIN 41401	±10% 0.25 w
W82	Film-type resistor	500 K ohm 5 DIN 41401	±20% 0.25 w
W83	Film-type resistor	100 K ohm 2% 2 DIN 41401	±2% 0.25 w
W84	Film-type resistor	8 K ohm 2% 2 DIN 41399	±2% 0.1 w
W85	Rotary film-type resistor	0120.512 500 ohms lin 12D	0.2 w*
W86	Film-type resistor	16 K ohm 5 DIN 41401	±10% 0.25 w
W87	Film-type resistor	30 K ohm 5 DIN 41402	±10% 0.5 w
W88	Film-type resistor	8 K ohm 5 DIN 41399	±10% 0.1 w
W89	Film-type resistor	50 K ohm 5 DIN 41398	±20% 0.05 w trim value

*Supplier: RFT Dorfhain

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Declassified in Part - Sanitized Copy Approved for Release 2013/01/25 : CIA-RDP80T00246A066200010001-5

Symbol	Name of Item	Reference Number	Electrical Values and Remarks
W90	Layer Film-type resistor	400 K ohm 5 DIN 41401	±10% 0.25 w
W91	Film-type resistor	16 K ohm 10% 5 DIN 41398	±10% 0.05 w
W92	Film-type resistor	400 K ohm 10% 5 DIN 41401	±10% 0.25 w
W93	Film-type resistor	1 M ohm 5 DIN 41401	±10% 0.25 w
W94	Film-type resistor	160 K ohm 5 DIN 41401	±10% 0.25 w
W95	Rotary film-type resistor	0120512 50 k lin. 12 D	Supplier: VEB Dorfhain 0.2 w
W96	Film-type resistor	160 K ohm 2% 2 DIN 41401	±2% 0.25 w
W97	Film-type resistor	40 K ohm 5 DIN 41402	±10% 0.5 w
W98	Film-type resistor	60 ohms 5 DIN 41398	±20% 0.05 w
W99	Film-type resistor	125 ohms 5 DIN 41398	±20% 0.05 w
W100	Film-type resistor	250 ohms 5 DIN 41398	±20% 0.05 w
W101	Film-type resistor	500 ohms 5 DIN 41398	±20% 0.05 w
W102	Film-type resistor	1 K ohms 5 DIN 41398	±20% 0.05 w
W103	Film-type resistor	2 K ohm 5 DIN 41398	±20% 0.05 w
W104	Film-type resistor	50 K ohm 5 DIN 41402	±10% 0.5 w
W105	Film-type resistor	100 ohms 5 DIN 41398	±20% 0.05 w
W106	Film-type resistor	10 K ohm 5 DIN 41398	±20% 0.05 w
W107	Film-type resistor	500 K ohm 5 DIN 41401	±10% 0.25 w
W108	Film-type resistor	200 K ohm 10% 5 DIN 41401	±10% 0.25 w
W109	Film-type resistor	30 K ohm 10% 5 DIN 41398	±10% 0.05 w
W110	Film-type resistor	500 ohms 5 DIN 41398	±20% 0.05 w trim value

Declassified in Part - Sanitized Copy Approved for Release 2013/01/25 : CIA-RDP80T00246A066200010001-5

Declassified in Part - Sanitized Copy Approved for Release 2013/01/25 : CIA-RDP80T00246A066200010001-5

Symbol	Name of Item	Reference Number	Electrical Values and Remarks
W111	Film-type resistor	160 ohms 5 DIN 41403	±10% 1 w
W112	Film-type resistor	500 ohms 5 DIN 41401	±10% 0.25 w
W113	Film-type resistor	160 ohms 2 % DIN 41399	±2% 0.1 w
W114	Film-type resistor	160 ohms 5 DIN 41399	±10% 0.1 w
W115	Combination resistor consisting of the following connected in parallel:		1.75 K trim value
W115/1	Film-type resistor	6 K ohm 5 DIN 41399	±10% 0.1 w
W115/2	Film-type resistor	2.5 K ohm 5 DIN 41399	±10% 0.1 w
W116	Film-type resistor	500 ohms 5 DIN 41401	±10% 0.25 w
W117	Film-type resistor	160 ohms 5 DIN 41399	±10% 0.1 w
W118	Film-type resistor	500 ohms 5 DIN 41401	±10% 0.25 w
W119	Film-type resistor	3 K ohm 5 DIN 41399	±10% 0.1 w
W120	Film-type resistor	1 K" 5 DIN 41402	±10% 0.5 w
W121	Film-type resistor	20 K' 5 DIN 41399	±10% 0.1 w
W122	Film-type resistor	1 M" 5 DIN 41401	±10% 0.25 w
W123	Film-type resistor	5 K' 2% 2 DIN 41399	±2% 0.1 w
W124	Film-type resistor	16 K' 2% 2 DIN 41399	±2% 0.1 w
W125	Film-type resistor	1.6 K' 5 DIN 41402	±10% 0.5 w
W126	Film-type resistor	1 M" 5 DIN 41401	±10% 0.25 w
W127	Film-type resistor	200 K" 2% 2 DIN 41401	±2% 0.25 w
W128	Film-type resistor	500 ohms 5 DIN 41398	±20% 0.05 w
W129	Dropped		

Declassified in Part - Sanitized Copy Approved for Release 2013/01/25 : CIA-RDP80T00246A066200010001-5

Declassified in Part - Sanitized Copy Approved for Release 2013/01/25 : CIA-RDP80T00246A066200010001-5

Symbol	Name of Item	Reference Number	Electrical Values and Remarks
W130	Film-type resistor	500 K 5 DIN 41401	±10% 0.25 w
W131	Film-type resistor	160 K" 5% 5 DIN 41401	±5% 0.25 w
W132	Dropped		
W133	Film-type resistor	800 K' 5% 51DIN 41401	±5% 0.25 w
W134	Film-type resistor	2 K" 5 DIN 41399	±10% 0.1 w
W135	Film-type resistor	1 K' 5 DIN 41404	±10% 2 w trim value
W136	Film-type resistor	2 M" 5 DIN 41401	±10% 0.25 w
W137	Film-type resistor	10 K" 5 DIN 41399	±10% 0.1 w
W138	Film-type resistor	50 K" 5 DIN 41401	±10% 0.25 w
W139	Film-type resistor	500 K' 5 DIN 41401	±10% 0.25 w
W140	Film-type resistor	1 M" 5 DIN 41401	±10% 0.25 w
W141	Film-type resistor	500 K" 5 DIN 41401	±10% 0.25 w
W142	Film-type resistor	160 K" 5 DIN 41401	±10% 0.25 w
W143	Film-type resistor	600 K' 5 DIN 41401	±10% 0.25 w
W144	Film-type resistor	500 K' 5 DIN 41401	±10% 0.25 w
W145	Film-type resistor	50 K' 5 DIN 41402	±10% 0.5 w
W146	Film-type resistor	10 K' 5 DIN 41403	±10% 1 w
W147	Rotary film-type resistor	0120512 500 k lin. 12D	Supplier: RFT-Dorfhain
W148	Film-type resistor	500 K' 5 DIN 41401	±10% 0.25 w
W149	Film-type resistor	2 M" 5 DIN 41401	±10% 0.25 w
W150	Film-type resistor	10 K' 5 DIN 41399	±10% 0.1 w
W151	Film-type resistor	50 K" 5 DIN 41401	±10% 0.25 w
W152	Film-type resistor	1 M" 5 DIN 41401	±10% 0.25 w
W153	Film-type resistor	2 M" 5 DIN 41401	±10% 0.25 w
W154	Film-type resistor	500 K" 5 DIN 41401	±10% 0.25 w

Declassified in Part - Sanitized Copy Approved for Release 2013/01/25 : CIA-RDP80T00246A066200010001-5

Declassified in Part - Sanitized Copy Approved for Release 2013/01/25 : CIA-RDP80T00246A066200010001-5

Symbol	Name of Item	Reference Number	Electrical Values and Remarks
W155	Film-type resistor	160 K 5 DIN 41401	±10% 0.25 w
W156	Film-type resistor	600 K 5 DIN 41401	±10% 0.25 w
W157	Film-type resistor	500 K 5 DIN 41401	±10% 0.25 w
W158	Film-type resistor	50 K 5 DIN 41402	±10% 0.5 w
W159	Film-type resistor	20 K 5 DIN 41403	±10% 1 w
W160	Film-type resistor	1 M 5 DIN 41401	±10% 0.25 w
W161	Film-type resistor	200 K 5% 5 DIN 41401	±5% 0.25 w
W162	Film-type resistor	600 K 5% 5 DIN 41401	±5% 0.25 w
W163	Film-type resistor	100 ohms 5 DIN 41398	±20% 0.05 w
W164	Film-type resistor	2.5 K 5 DIN 41399	±10% 0.1 w trim value
W165	Film-type resistor	25 K 5 DIN 41398	±20% 0.05 w
W166	Film-type resistor	10 K 5 DIN 41398	±20% 0.05 w
W167	Film-type resistor	10 K 5 DIN 41398	±20% 0.05 w
W168	Film-type resistor	100 K 5 DIN 41401	±10% 0.25 w
W169	Dropped		
W170	Film-type resistor	100 ohms 5 DIN 41401	±10% 0.25 w

Declassified in Part - Sanitized Copy Approved for Release 2013/01/25 : CIA-RDP80T00246A066200010001-5

Declassified in Part - Sanitized Copy Approved for Release 2013/01/25 : CIA-RDP80T00246A066200010001-5

8-kv High-Voltage Unit

Circuit Elements List No. 1421.002-01310 SL (4)

Symbol	Name of Item	Reference Number	Electrical Values and Remarks
Bu 1	Plate connection	2251 (5)	Supplier: RAFENA
C 1	Capacitor consisting of following in series connection:		0.0152 µf
C 1/1	Paper capacitor	0.025/2 after DIN 41163	0.025 µf ±20%, rated voltage 2 kv, Bv G 4661
C1/2	Paper capacitor	0.025/2 after DIN 41163	
C 2	Paper capacitor	0.025/2 after DIN 41163	0.025 µf ±20%, rated voltage, 2 kv, Bv G 4661
C 3	Paper capacitor	0.025/2 after DIN 41163	
C 4	Paper capacitor	0.025/2 after DIN 41163	
Ro 1	Tube	EY 51	
Ro 2	Tube	EY 51	
Rs 1	Medium round relay [sic]	4722:30-445	Supplier: FMW Leipzig
St 1	Terminal strip	A S DIN 41621	8 poles
Tr 1	Plate transformer	0480.999-50010 Bv (4)	Design part
Tr 2	500-cycle dividing transformer	0482.999-10044 Bv (4)	Design part
W 1	~~Film~~ Layer-type resistor	60 K ohm 5 DIN 41403	±10% 1 w
W 2	~~Film~~ Film-type resistor	2 M ohm 5 DIN 41401	±10% 0.25 w
W 3	Dropped		
W 4	Film-type resistor	1.6 M ohm 5 DIN 41402	±10% 0.5 w
W 5	Resistor	8 M ohm HWK/IV	±20% Supplier: WBN Teltow
W 6	Resistor	40 M ohm HWK/IV	±20% Supplier: WBN-Teltow

Declassified in Part - Sanitized Copy Approved for Release 2013/01/25 : CIA-RDP80T00246A066200010001-5

Declassified in Part - Sanitized Copy Approved for Release 2013/01/25 : CIA-RDP80T00246A066200010001-5

Symbol	Name of Item	Reference Number	Electrical Values and Remarks
W 7	Resistor	40 M ohm HWK/IV	+20% Supplier: WBN-Teltow
W 8	Resistor	40 M " HWK/IV	+20% Supplier: WBN-Teltow
W 9	Resistor	40 M " HWK/IV	+20% Supplier: WBN-Teltow
W10	Resistor	40 M " HWK/IV	+20% Supplier: WBN-Teltow
W11	Resistor	40 M " HWK/IV	+20% Supplier: WBN-Teltow
W12	Resistor	40 M " HWK/IV	+20% Supplier: WBN-Teltow
W13	Resistor	40 M " HWK/IV	+20% Supplier: WBN-Teltow
W14	Resistor	40 M " HWK/IV	+20% Supplier: WBN-Teltow

Declassified in Part - Sanitized Copy Approved for Release 2013/01/25 : CIA-RDP80T00246A066200010001-5

Declassified in Part - Sanitized Copy Approved for Release 2013/01/25 : CIA-RDP80T00246A066200010001-5

Key to Drawing No. 1421.002-00001 Sp 9: 1) Film-type resistors; 2) and so forth; 3) measurement point; 4) wire-wound resistors; 5) sweep oscillator; 6) input blocking oscillator; 7) multivibrator; 8) limiter stage; 9) final intermediate-frequency amplifier; 10) tuning; 11) distance; 12) dead-ahead marker generator; 13) range switch; 14) contrast; 15) background brightness; 16) illumination; 17) video amplifier; 18) marker-mixer tube; 19) distance-measurement unit; 20) north-marker generator; 21) focusing tube; 22) marker brightness; 23) focusing; 24) rain-clutter suppression; 25) dilation; 26) from oscillator G 3; 27) from low-voltage line unit N 3; 28) from auxiliary line unit Z 3; 29) from compass; 30) from low-voltage line unit N 3; 31) from antenna drive A 3; 32) terminal box for H 3; 33) high-voltage unit; 34) markers; 35) dead ahead; 36) north; 37) compass angle-data transmitter; 38) antenna angle-data transmitter; 39) housing switches; 40) Sch 6, Sch 7, Sch 8 and Sch 9 are mechanically connected (range switches); 41) RFT Funkwerk Koepenick; 42) main display device H 3; 43) released 6 December 1958, Katitschke.

Declassified in Part - Sanitized Copy Approved for Release 2013/01/25 : CIA-RDP80T00246A066200010001-5

Declassified in Part - Sanitized Copy Approved for Release 2013/01/25 : CIA-RDP80T00246A066200010001-5

FGS 392 Anticollision Apparatus

Circuit Elements List No. 1420.008-00004 EL 1

No.	Count	Name of Item	Reference No.	Remarks
1	1	Magnetron	730	
2	2	Nullode	1 B 24	
3	2	Metal klystron	723 A/B	Supplier: WF Berlin-O'weide
4	2	Tube	SRS 454	
5	2	Tube	SRS 4452	Heavy duty. Supplier: WF Berlin-O'weide
6	2	Tube	ECL 81	
7	2	Tube	ECC 84	
8	20	Tube	EF 80	
9	3	Tube	EAA 91	
10	9	Tube	ECC 81	
11	2	Tube	ECC 82	
12	2	Tube	EC 92	
13	2	Tube	EL 84	
14	2	Tube	EL 83	
15	2	Tube	EL 84	
16	2	Tube	EY 81	
17	3	Rube	UL 84	
18	1	Tube	B 23 M 2 DN	Afterglow, aluminum backing
19	5	Stabilizer	StR 85/10	
28	2	Germanium diode	OA 624	
29	3	Germanium diode	OA 625	
30	2	Germanium diode	OA 643	Model III, Supplier: VEB WBN Teltow
31	2	Germanium diode	OA 683	
32	3	Germanium diode	OA 705	
33	20	Silicon diode	OA 513	**Model I, Supplier: WBN Teltow

Declassified in Part - Sanitized Copy Approved for Release 2013/01/25 : CIA-RDP80T00246A066200010001-5

Declassified in Part - Sanitized Copy Approved for Release 2013/01/25 : CIA-RDP80T00246A066200010001-5

No.	Count	Name of Item	Reference No.	Remarks
34	4	Germanium junction diode	OY 111	Supplier: VEB WBN Teltow
35	2	Copper-oxide rectifier	A 0 25/30 FWB-N 525.221	0.25 ma direct current, peak voltage 30 v
36	2	Selenium rectifier	E 300/120-0.04/25 fs Order No. 11 a	* 300 v_{eff} 120 v = = 0.04 amp
37	2	Selenium pill rectifier	E1000/375-0.005 Order No. 2088	* 1000 v_{eff} 375 v = = 0.005 amp
38	2	Selenium pill rectifier	E 800/300-0.005 Order No. 2078	* 800 v_{eff} 300 v = = 0.005 amp
39	2	Selenium pill rectifier	E 640/240-0.005 Order No. 2070	* 640 v_{eff} 240 v = = 0.005 amp
40	2	Selenium pill rectifier	E 540/202.5-0.005 Order No. 2065	* 540 v_{eff} 202.5 v = = 0.005 amp
41	2	Selenium pill rectifier	E 240/90-0.005 Order No. 2050	* 240 v_{eff} 90 v = = 0.005 amp
42	4	Selenium rectifier	E 250/100-0.3/25 fs Order No. 109 a	* 250 v_{eff} 100 v = = 0.3 amp
43	2	Selenium rectifier	E575/230-0.15 fs Order No. 96 a	* 575 v_{eff} 230 v = = 0.15 amp
44	4	Selenium rectifier	E 500/200-0.3 fs Order No. 119 a	* 500 v_{eff} 200 v = = 0.15 amp
45	4	Selenium rectifier	E 400/160-0.15 fs Order No. 89 a	* 400 v_{eff} 160 v = = 0.15 amp
46	2	Selenium rectifier	2 x 1/2B 450/360-0 -0.08 fs Order No. 512 a	* 450 v_{eff} 360 v = = 0.08 amp
50	6	Signal lamp	24 v, 3 w, clear Socket B 10 s	Supplier: Gluehlampenwerk [Incandescent Lighting Plant] Eisenach

*Supplier: RFT Grossraeschen
**In pairs in accordance with "Technical Specifications for Silicon Diodes" dated 13 June 1958

Declassified in Part - Sanitized Copy Approved for Release 2013/01/25 : CIA-RDP80T00246A066200010001-5

Declassified in Part - Sanitized Copy Approved for Release 2013/01/25 : CIA-RDP80T00246A066200010001-5

No.	Count	Name of Item	Reference No.	Remarks
52	10	G fuse	0.035 C DIN 41571	0.035 amp 250 v DC medium delay
53	10	G fuse	0.05 C DIN 41571	0.05 amp 250 v DC medium delay
54	10	G fuse	0.06 C DIN 41571	0.06 amp 250 v DC medium delay
55	10	G fuse	0.1 C DIN 41571	0.1 amp 250 v DC medium delay
56	10	G fuse	0.16 C DIN 41571	0.16 amp 250 v DC medium delay
57	10	G fuse	0.2 C DIN 41571	0.2 amp 250 v DC medium delay
58	10	G fuse	0.25 C DIN 41571	0.25 amp 250 v DC medium delay
59	10	G fuse	0.6 C DIN 41571	0.6 amp 250 v DC medium delay
60	30	G fuse	1 C DIN 41571	1.0 amp 250 v DC medium delay
61	20	G fuse	1.6 D DIN 41571	1.6 amp 250 v DC medium delay
62	20	G fuse	2.5 D DIN 41571	2.5 amp 250 v DC medium delay
63	20	G fuse	4 D DIN 41571	4.0 amp 250 v DC medium delay
64	10	G fuse	6 D DIN 41571	6.0 amp 250 v DC medium delay
65	10	G fuse	E 16 Reference No. 24402.11	1.25 amp superlong delay Supplier: IKA-ETS
66	30	G fuse	E 16 Reference No. 24402.10	1.0 amp Supplier: IKA-EIS
67	30	G fuse	E 16 Reference No. 24403.4	6.0 amp Supplier: IKA-EIS
70	1	Flexible wave-guide	Type 9401.2 (156 lg)	Supplier: Kabelwerk Vacha/Rhön Cable Plant
71	1	Angle-data unit 70/80/6	6911.403-10001 Bv (4)	Design part

Declassified in Part - Sanitized Copy Approved for Release 2013/01/25 : CIA-RDP80T00246A066200010001-5

Declassified in Part - Sanitized Copy Approved for Release 2013/01/25 : CIA-RDP80T00246A066200010001-5

No.	Count	Name of Item	Reference No.	Remarks
72	1	Angle-data unit 70/80/26	6911.154-10002 Bv (4)	Design part
73	1	Angle-data unit 90/115/4	6911.352-10004 Bv (4)	Design part
75	2	Paper capacitor	1446.002-02005 Bz (5)	0.025 µf, 12/18 kv, after KoBv 4700 Supplier: Kondensatorenwerk Gera
76	1	Calibrating potentiometer	50 K, B4* MD 40/A**	Linearity 0.5%, 4 w Supplier WBN Teltow
78	1	12-kv High-voltage line unit	1446.002-01060	Design part
79	1	8-kv High-voltage line unit	1421.002-01310	Design part

*Special model
**Axial length 20 mm, p = 8 mm.

Declassified in Part - Sanitized Copy Approved for Release 2013/01/25 : CIA-RDP80T00246A066200010001-5

Declassified in Part - Sanitized Copy Approved for Release 2013/01/25 : CIA-RDP80T00246A066200010001-5

FGS 392 Anticollision Apparatus

Parts List No. 1420.001-00001 to 00012 ZL

No.	Count	Name of Item	Reference No.	Remarks
1	1	Tool pouch with contents	1420.001-01201	
2	2	Minus flange	1077.008-00004 (5)	*
3	2	Plus flange	1077.008-00002 (5)	*
4	6	Packing ring	1077.008-00006 (5)	*
5	6	Plate	1077.008-00007 (5)	*
6	20	Cylindrical screw	M 4 x 8 DIN 84-5 s	* Galvanized, cadmium-plated (sea)
7	1	"E" angle piece	Skz 23253-01041 (4)	*
8	1	"H" angle piece	Skz 23253-01044 (4)	*
9	1	Leak tester	1499.013-00001	*
10	1	Manometer	1.6 atm excess, 63 mm diameter, M 12 x 1.5	* DHZ EFO Berlin, Commercial.
11	1	Bicycle air pump		Commercial
12	1	Protective cap	1446.002-02260 (4)	**
13	1	Test unit	1420.001-01001.	
14	1	Flexible waveguide	Type 9401.2 (156 lg)	*Supplier: VEB Kabelwerk Vacha
15	2	Energy conductor	1077.005-00002 (5))	*
16	4	Acceptance document	1420.001- Apr.	See installation parts list

*To be removed from accessory box during installation.
**Removed from accessory box during shipment of apparatus.

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